DOCUMENT RESUME

ED 068 277 SE 014 493

TITLE	Learning Activities Packages, Earth Science and Life Science.
INSTITUTION	Miller Junior High School, Marshalltown, Iowa.
PUB DATE	72
NOTE	239p.
AVAILABLE FROM	Miller Junior High School, South Eleventh Street, Marshalltown, Iowa 50158 ($10.00 for both sets, $5.00 per set, or $1.00 each activity package)
EDRS PRICE	MF-$0.65 HC-$9.87
DESCRIPTORS	*Biology; *Curriculum; *Earth Science; *Junior High Schools; Science Activities; *Teaching Procedures

ABSTRACT

Thirteen "Learning Activities Packages" for junior high school students focus on earth science and life science. Individual packages can be used with some lecture and films. Each learning activity package lists behavioral objectives and concepts to be used. Lists of reading assignments and references, along with laboratory activities, are also included, followed by a list of resource materials (films, tapes, film strips and enrichment materials), a vocabulary list, grade specifications in terms of required and supplemental activities, and test items. The activity packages are prepared by Miller Junior High School, Marshalltown, Iowa. (Page 128 may be illegible.) (Author/PS)

LEARNING ACTIVITIES PACKAGES

Earth Science and Life Science
Miller Junior High School
Marshalltown, Iowa 50158

There are a total of thirteen (13) LAP's, six on Earth Science and seven on Life Science. A complete set of thirteen packets has a charge of $10.00 per set, or $5.00 for just Earth or Life Science sets, or $1.00 each. Make payment to: Miller Junior High School.

The titles are:

Earth Science

1. Introduction to Earth Science - Matter and Energy
2. Rocks and Minerals of the Earth's Crust
3. The Changes in the Earth
4. Golden Boy, Inc.
5. Stars in Space
6. The Giant Bubble of Spaceship Earth

Life Science

1. Introduction to Life Science
2. Plants Without Pipes
3. Vascular Plants
4. Animals
5. The Skeletal and Muscular System
6. The Human Body - Food and Supplier to the Cell
7. Continuity of Life

Miller Jr. High
Marshalltown, Iowa
Jerry Cunningham
Ross Iverson

A LEARNING ACTIVITY PACKAGE APPROACH TO JUNIOR HIGH SCHOOL SCIENCE

Introduction:

When Sputnik went up so did the status of science in American schools, and with the status came money and man power. The money came to individual classrooms as equipment and better trained teachers, also a great deal of money and man-power went into developing curriculum projects. While most of these projects are very good, they are not always appropriate for each specific time and place. The projects did provide a great many materials to choose from. Our classrooms were specific places and we had a desire to give our students the best possible science experience in the seventh and eighth grade. Our goals were to have a low-structured student centered program that made the best use of our physical plant, equipment, and teacher power. What we came up with was a design which included a format and procedure and a set of materials.

We feel our design is adaptable to many situations and may offer some ideas to you. The courses we teach are exploratory. We hope to offer the student a wide variety of new experiences while developing a continuing interest in the study of science and a systematic approach to solving problems.

Procedure and Philosophy:

We use a "Learning Activity Package" (LAP) approach coupled with some lecture and films. A LAP consists of: (1) Behavioral Objectives (2) Concepts to be used (3) Reading assignments and references (4) All lab activities (5) Resource reference films, film loops, tapes, film strips and enrichment materials (6) Vocabulary list (7) Grade requirements in terms of required and supplemental activities (8) All tests. Each LAP is constructed to consume one to four weeks time. The course is about 70% lab. The heart of the program centers on the LAP and the way it is used. An explanation of a front page (Figure A) will give a feeling for our procedure and philosophy. The LAP we are using for illustration is on Vascular Plants. This is used with seventh and eighth graders.

The "Test Day" blank is filled in with the test day which is also the date the LAP work is due. A student can hand his LAP in for a grade as soon as he has achieved the grade desired. We encourage each student to get as high a grade as possible. For example if a student came to turn in his LAP for a "C" with a week to go before the due date we will be very reluctant to take it. Instead, we will start discussing some of the supplemental activities picking those we feel will have the highest interest for that particular student. If he can be talked into a "B" possibly he can be talked into an "A". If for some reason the test day comes and the work is not completed (and this does happen) we give them a grade for what they have with the promise that if and when more is turned in, their grade will be changed accordingly.

Jerry Cunningham
Ross Iverson

(FIGURE A)

Marshalltown, Iowa

THE VASCULAR PLANTS

(Plants with water pipes)

NAME _____

CLASS _____

TEST DAY _____

TEXT: The World of Living Things (WLT) - Chapter 5
Harcourt Brace and World Inc.
Modern Science I - pages 269 - 276
Holt Rinehart and Winston, Inc.
Life - Its Forms and Changes - pages 274 - 305
Harcourt Brace and World Inc.

REQUIREMENTS: SAVE ALL PAPERS

- ☐ 1. Read Chapter 5 of WLT, pp. 76-101 and answer in writing the "Check your understanding" questions on pages 85-88 and questions 4,5,6,7, on page 98.
- ☐ 2. Read in Modern Science I - pp. 269-276.
- ☐ 3. Do "Seed Lab". (See page 5)
- ☐ 4. Do "Flower Lab". (See page 6)
- ☐ 5. Write out a short meaning to "The Vocabulary of Science" on pages 99-100 of WLT.
- ☐ 6. "Current Science" questions as assigned.
- ☐ 7. "Stomates Lab." See page 6½.

SUPPLEMENTAL ACTIVITIES:

Only to be done after all other requirements have been completed and approved.

- ☐ 1. Do "What Are the Higher Plants" activity on page 7 & 8.
- ☐ 2. Do "Living Chloroplast Lab." (See page 9)
- ☐ 3. Do the "Onion Root Tip Lab". (See page 10)
- ☐ 4. Seed Cone Collection. (See page 11)
- ☐ 5. Twig Collection. (See page 11)
- ☐ 6. Independent projects - see instructors.
- ☐ 7. "Seed Germination Lab". (See page 12)
- ☐ 8. "Finding Water Pipes Lab". (See page 13)
- ☐ 9. "Fern Spore Case Lab". (See page 14)

GRADES: For a C - do requirements
For a B - do requirements plus 2 supplemental activities.
For an A - do requirements and 4 supplemental activities.

When the student hands a LAP in they get the next one to start on. In this way we have what might be called a "modified continuous grogress" program in that different students are working on different LAP's which include many activities at the same time while all have the same due date for the completion of any one packet. Due dates are reference points in time.

We use a multiple text with books available in the science rooms and study areas. The books may be checked out overnight. In any one LAP we generally involve three texts. There are nine texts used in the seventh and eighth grade program. There are also several reference books which are available in multiple copy along with a very substantial library of single copy up to date books. We also have a wide variety of periodicals and magazines dealing with science and nature.

Requirements

You will note that the first seven items on the packet are listed as requirements. These are the activities that we feel that each student must do in order to meet the basic objectives of the course. If he does these in a satisfactory manner he has earned a grade of C. As each requirement is completed (there is no particular order in which he must do these except that we do recommend that most students do the reading first). The student brings the completed work to an instructor for the instructor's O.K. or approval. If he gets the O.K. he may then go on to another activity. All work is checked on the spot with the student present. In checking written work we can ask those simple questions that will clarify a statement in a word or two, those things which are so often overlooked when going through a stack of papers. In the case of lab work we look at this paper and then say, "Show me." For example, in part of the seed lab they are asked to take apart a soaked bean seed and sketch the side of the seed which contains the embryo plant and label the cotyledon, plumule and radicle. By having them show us the sketch and the bean, we can see what they have done. This process could be described as a "mini lab practicle". It is very probable that we work harder and faster in this system than in most traditional systems. It is our responsibility to get to the students when they can show us. If they come in and ask if we will "O.K." this and we say, "Show me," and they say they did it two days ago or so, we come back by saying, "Do it over." Before long they catch on. It is of utmost importance in orienting and adjusting students to this procedure.

An important part of our philosophy is that the acceptance level is not the same for all students, ie - some students will do a better job on one requirement than others. This is one of the places where individualized instruction becomes a vital factor in this program. We must know our students well enough to realize their capabilities and then encourage them to work to these levels.

Since this is a success oriented course there must be some level of excellence at which all of the students may succeed, but this level will vary from student to student. Students taking this course range from Special Ed. students to the best students in our school. They are all capable of succeeding at least to the C level.

Grades below C are reserved for students who do not, through lack of effort, meet the basic requirements. One of our goals is to see that this doesn't happen to anyone. We have not succeeded in this goal as yet, but are getting closer to it all of the time. Last grading period we had zero F's and 11 D's from 222 students. The other grades were 61 C's, 76 B's and 71 A's, and three incompletes.

Supplemental Activities

There is no magic number of supplemental activities. Whenever we think of or find something that looks good we add it. Unlike the requirements, the supplemental activities do not have to be appropriate for all students, nor is it necessary to have enough equipment or books to accomodate a large number of students. If the student can't get materials he can always do a different activity. No one supplemental activity must be done by any student to get an "A". Note supplemented activity number six. "Independent project - see instructor". This leaves the door wide open to the students as well as to the instructor. A project can be so complex and involved that a young genius will find satisfaction from a worthy task completed or so simple that a special education student can find self satisfaction and come away with a feeling of success.

While it is not necessary for any one supplemental activity be available to all, it is essential that all students have some of these activities readily available. In this particular LAP supplemental activities 1, 2, and 9 can be completed by a large number of students. Supplemental activity number 3 on the other hand is available to only the top students even though the onion root tips are abundant in the classroom.

We encourage the student to set up a plan of attack when he starts a new LAP. The statement "only to be done after all the requirements have been completed and approved" is included for our protection and the student's guidance even though it is not totally adhered to. For example if a student knows he wants an "A" and sets out to get it, he can start any place, in fact some activities or projects may take a waiting period of a week or more and should be started at the earliest opportunity. On the other hand, a student we must push to get the requirements done will be encouraged to do those first. The student does not have to hand in or register a plan as is practiced in some "contract" grading systems. The individual attention given the student, combined with a knowledge of their past experience, gives us the information we need to make demands on students.

The Open Lab

We feel that the Open Lab is a vital part of this program. Open Lab is a plan where by students can come to the science area to work during any free time that they may have during the day. With traditional scheduling, this could be during study hall time or before school or after school. With modular scheduling they may schedule themselves in to the science area during what is commonly called unscheduled time. Of course, this means that the Lab area must have space for them to work and there must be an instructor available to supervise them while they are there. We are fortunate enough to be able to meet both of these requirements. The amount of open lab that can be held depends on such things as teacher load, space available, and student and teacher scheduling. At the present time we offer open lab two-thirds of the time.

It has been our experience that the open lab concept is much more valuable to the program than the Resource Center approach. With proper planning the resource materials needed (A.V. and etc.) can be stationed in the lab areas. This relieves the teacher from the Resource Center area and makes them available to man the open lab space.

Tests:

. Very few written tests are given to the students taking this course. Those given are used more for motivation purposes than for evaluation. Usually one test per LAP is given. This test is over the concepts listed in the front part of the LAP. The student is told to study the concepts and that there will be the same number of multiple choice questions on the test. As there are concepts in the packet--one for each concept. Any student who studies and learns the concepts can score high on the test. (Success oriented). If a student receives less than a "C" on the test he is required to take it over - (more than once, if necessary), until at least a "C" grade is obtained.

The test grade counts somewhat less than half of final grade with the LAP grade making up the major portion.

The Science courses we teach are one semester in length and have six to eight LAPs each depending on how the instructors choose to combine them and on how fast students work. We take 1/2 of the 7th graders and 1/2 of the 8th graders each semester. They are mixed indiscrimately in the classes. One year we teach Life Science, the next year we teach Earth Science to all 7th and 8th graders, 1/2 each semester. This way each student will reach the end of the 8th grade with 1 semester of Life and 1 semester of Earth science. The main advantage of this, to us, is that we have only 1 preparation at a time. The main advantage to the student is that the 8th graders are able to help the 7th graders adjust to this system of learning. The semesters in the 7th and 8th grades a student is not in Science he is in a Health and Family Living course which is part of our exploratory junior high school program.

We have been using the Learning Activity approach coupled with team teaching for four years. We have used it under both traditional and modular scheduling and find that it works well in either case. Some indication of this program's success is the fact that it has been adopted by all three junior high schools in our system.

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G. A. Cunningham
Marshalltown, Iowa

INTRODUCTION TO LIFE SCIENCE

NAME _____
TEST DAY _____
SECTION DAY _____

TEXTS:

Modern Science I
Life: Its Forms and Changes

REQUIREMENTS:

- ☐ 1. Study pages 196-226 in Modern Science I and write out the answers to the review questions on pages 204 and 209.
- ☐ 2. Write out a short meaning to the Words to Remember on page 223 of M.S. I
- ☐ 3. Microscope Technique Lab - See page 5 of this L.A.P.
- ☐ 4. Typical plant cell Lab - See page 6 of this L.A.P.
- ☐ 5. Typical animal cell Lab - See page 7 of this L.A.P.
- ☐ 6. Make a Key Lab - See page 8 and 9 of this L.A.P.
- ☐ 7. "Current Science" questions as assigned.

SUPPLEMENTAL ACTIVITIES

- ☐ 1. Photosynthesis and Starch Production Lab - See page 10 of this L.A.P.
- ☐ 2. Yeast Cell Reproduction - See page 11 and 12 of this L.A.P.
- ☐ 3. Mold Here - Mold There - Mold Everywhere - Mold-Mold-Mold See Page 13 of this L.A.P.
- ☐ 4. Student activity on page 214 of Modern Science I. (You must collect your own planaria - see other books and the instructor).
- ☐ 5. Complete Nature of Life study guide activity on pages 14-17.
- ☐ 6. Do both Student activities on page 220, of Modern Science I.
- ☐ 7. Do an Independent Project. See an instructor before you start.
- ☐ 8. Do the student activity on page 222 of Modern Science I. Make your own chart.

GRADES: For a C - Do all requirements and have them checked by an instructor before the test day.

For a B - Do all requirements and two supplemental activities and have them checked before the test day.

For an A - Do all requirements and four or more supplemental activities and have them checked before test day.

BEHAVIORAL OBJECTIVES

Introduction to Life Science

1. Given a blank slide, cover slip, and eye dropper, the student will be able to prepare a "wet mount slide".

2. The student will be able to properly set up and focus a microscope if given a microscope, slide, and light source.

3. Given a microscope, slide, cover slip, iodine, and a piece of onion skin, the student will be able to prepare a wet mount slide of onion skin stained with iodine and by using a microscope, construct a diagram of an onion skin cell showing the cell wall, cytoplasm, and nucleus as well as indicating the position of the cell membrane.

4. Given the same materials as in behavioral objective #3 with exception of onion skin, the student will be able to rub off cheek lining cells and prepare a wet mount slide of them. The student will be able to diagram a cell showing the position of the limiting cell membrane cytoplasm, and nucleus.

5. Given a prepared slide of textile fibers and a microscope, the student will be able to demonstrate the differences between the fibers, other than color, by creating a diagram of each type of fiber to the instructors satisfaction.

6. Given an appropriate prepared slide and microscope, the student will be able to determine the relative depth of different objects and demonstrate this by identifying the level of each object with 80% accuracy.

7. Given iodine and substances to be tested the student will be able to determine the presence of starch with 80% accuracy.

8. Given a green plant, some black construction paper, alcohol, and iodine, the student will be able to demonstrate that a green leaf must have sunlight to produce starches.

9. Given a moist piece of home-made bread, the student will be able to demonstrate the presence or absence of mold spores in a weeks time with 90% accuracy.

10. Having studied pages 215-217 in Modern Science I, the student will be able to construct a diagram depicting the principle of our classification system including the seven main steps.

11. Given a minimum of six items, the student will be able to construct a key for those items with 90% accuracy.

12. The student will be able to demonstrate in writing, at a level of 80% accuracy, a knowledge of the meanings of the vocabulary words on page 223, of Modern Science I.

INTRODUCTION TO LIFE SCIENCE

CONCEPTS:

1. The process of taking food into the body is called ingestion.
2. Foods taken in by an organism are changed to useable forms through a process of digestion.
3. The process by which an organism uses oxygen to release energy is known as respiration.
4. The waste materials produced in the body of an organism are removed in the process of excretion.
5. The living material of a cell taken together is called protoplasm.
6. Vacuoles are nonliving cell parts.
7. The cytoplasm is the liquid portion of the cell.
8. Only plant cells have a cell wall.
9. A group of organs working together is called a system.
10. In order for an organism to be a true organism, it must consist of at least one cell.
11. Water and carbon dioxide are the raw materials of photosynthesis.
12. Water and carbon dioxide are products of respiration.
13. Respiration occurs in all living cells.
14. Living things that cannot manufacture their own food are called food consumers.
15. Spontaneous generation is a belief that living things arise from non-living things.
16. Fission, budding and vegetative reproduction are types of asexual reproduction that involve only one parent.
17. In budding, the mother cell is larger than the daughter cell.
18. Vegetative reproduction is a process by which a new plant develops by breaking away of some part from the parent plant.
19. Sexual reproduction involves two parents.
20. Gametes are the reproduction cells.
21. Genus and species are the two parts of the scientific names of an organism.
22. Both internal and external structures of an organism are studied in order to classify it.

23. The microscope has a stage on which to place the speciman to be observed.

24. Activities necessary for life are called life processes.

25. The ameba is a true organism.

26. The food making process that takes place in a green leaf is called photosynthesis.

27. Chlorophyll is the plant material which absorbs the suns energy.

28. Increasing the amount of CO_2 present will increase the rate of photosynthesis.

29. Reproductive stems that occur along the surface of the ground are called runners.

30. Underground leaves containing food are called bulbs.

31. From the most general to the most specific, the classification system goes as follows:
    (1) Kingdom
    (2) Phylum
    (3) Class
    (4) Order
    (5) Family
    (6) Genus
    (7) Species

32. The classification of man is as follows:
    (1) Kingdom - Animal
    (2) Phylum - Chordala
    (3) Class - Mammdia
    (4) Order - Primate
    (5) Family - Hominidae
    (6) Genus - Homo
    (7) Species - sapiens

FILMSTRIPS - Science R.C.
FS-75 Balance of Nature
FS-76 Cycle of Nature
FS-77 Conservation

FILMLOOPS: - Science R. C.

1. "See It Big" the Microscope
2. "Classification"

FILMS:
2328 Cell Biology = Life Functions
Jan. 26-29
2324 Clay - Origin of the Species
Feb. 2-8
1825 DNA Molecule of Heredity
Feb. 4-11

TAPES: - Science R. C.
M.S. Ch 7 A & B pages 198 to 209

M.S. Ch 7 C & D pages 209 to 223

Introduction to Ecology

MICROSCOPE TECHNIQUE LAB.
Requirement #3

Part A:

Set up a microscope and light so that when you look into the microscope the view is as bright as possible. You can do this by moving the light or the mirror. If you have trouble get someone to help you.

Once you have the microscope you need a (1) slide, (2) slide cover, (3) a small letter "e", the smallest you can find in the newspaper. Place the "e" on the slide right side up and put the slide cover on top to keep it from moving. Now place the slide on the stage of the microscope and center the letter over the hole in the stage. Next be sure the microscope is on its lowest power and the stage is as close to the tube as possible. Now look in the microscope and focus on the letter. You may have to move the slide to center the letter in your field of vision. You should be able to see the entire letter in your field of vision. You should be able to see the entire letter at the same time - if not go back to the newspaper and find a smaller "e". Draw the letter exactly as it appears in the microscope. You may wish to have an instructor check your slide before you start drawing. Get your drawing O.K.'ed. Draw here! Use a pencil.

Part B.

For this part you must get a prepared slide "silk-thread WM 94w9112". Simply tell which color of thread is on top - in the middle - on the bottom.

Part C.

Now take slide "Textile fiber-w.m. 94w9113" and sketch each fiber under high power. Use color name to identify each drawing. Draw on the back of this sheet.

TYPICAL PLANT CELL

Requirement #4

For this lab you will use onion skin. The skin to use is on the inside surface of the pieces of onion. Peel off a small piece of the skins and place it on a clean slide. Be very careful not to let it wrinkle up. It must be smooth and flat. The skin is only one cell thick and this makes it easy to see the cells. If it is doubled up it is much more difficult to examine a single cell. Add several drops of iodine to the slide and place a slide cover on it. You are now ready to examine it under your microscope. Adjust the microscope as you did in "technique lab." Be sure you start on low power, and change to high power after it is in focus under low power. Refocus using the fine focus knob (the little blue microscope does not have one so just use the focus knob.)

Keep slide moist at all times.

Make the drawing large! ONE CELL IN DETAIL with the outline of surrounding cells on this page.

Label: 1., 2., 3., 4. Labels should be in a row to the right of the drawing, no pointer lines should cross. No arrow heads-on pointer lines. Use a pencil - neatness counts.

1. cell wall
2. cytoplasm
3. mucleus
4. cell membrane

TYPICAL ANIMAL CELL

Requirement #5

The inside of your mouth is lined with small soft cells that are typical of most animal cells. You can remove a number of these cells by rubbing your finger inside your cheek. Take a clean slide and pile the cells from your cheek on it forming a drop or two in the middle of the slide. Now, so that you can see the inside of the cell better, add a drop of iodine and one drop of acetocarmine right on top of the material from inside your mouth and lay a slide cover on it. The slide is now ready to examine. Adjust the microscope as you did before being certain to start on low power and get it in focus. Switch to high power and use fine focus only.

The cells will look like fried eggs. If the margin of the cell is uneven and there is no particular shape you are looking at a dead, ruptured cell. Find some healthy round ones. Do the cells you are looking at look anything like the cell shown in #2 on page 71 of Life: Its Forms and Changes? _____ Where did the cells in the picture come from? _____

Make a detailed drawing of one cell and label:

1. Cell membrane
2. Cytoplasm
3. Nucleus

and anything else you can see.

Make the drawing BIG!

Use a pencil.

MAKE A KEY LAB

Requirement #6

Get a "Key Lab" package in the Science Resource Center. When you get the package divide the contents into two groups.

What do all of the items in one of the groups have in common, and what makes one group separate from the other? _____

Now take one of the groups and divide it into two groups. (Save the other group, you will use it later.)

What is the difference you used to divide the items? _____

Continue to divide the groups until you have only groups of <u>one</u> left. You may use differences in color, size, shape, smell, feel, or anything else you can sense with your brain.

It is now time to make a Key of these items. You have already done much of the work when you were dividing things into two groups. <u>Every</u> step of the key has 2 parts - Part A and Part B.

For an example of how a key works use the following key to identify the five things hanging on the wall under the sign "Key Things". What is the name we have given each "thing".

1A The object is made of metal .... go to 2A or 2B v _____

1B The object is not made of metal..go to 3A or 3B w _____

2A It is black .....Charley x _____

2B It is not black .....Mable y _____

3A The object is longer than 10 inches..go to 4A or 4B z _____

3B The object is 10 inches or less.....Joe

4A The object is made of wood.....Paul

4B The object is not made of wood.....Jane

If you have gotten this far you are ready to complete this activity by making a key of six people including yourself and have it checked. The six people must be present when you have it checked so it is suggested that you do this last part in a class - not in the Resource Center.

These are some of the things you might consider in making a people key:

1. Boy or girl
2. hair color
3. Glasses
4. Freckles
5. height
6. weight

Do not use characteristics which change from day to day such as clothing.

PHOTOSYNTHESIS AND STARCH PRODUCTION

Supplemental Activity #1

The purpose of this activity is to demonstrate the need of sunlight to produce starch in a green leaf. You will also learn that chlorophyll will disolve in alcohol.

You will use iodine to detect the presence of starch.

Step #1

Using black construction paper and paper clips, cover both sides of part (not the entire leaf) of a leaf. Be sure that your leaf is marked very clearly - Do not Touch Anyone Elses Leaf! Let it stand for at least a week, and preferably for two weeks.

While you are waiting for your leaf, try the starch test with iodine so you will know what you are doing when it comes time to use it. When iodine is dropped on starch, it turns the substance black. You may demonstrate this to yourself by using a piece of bread or cracker on a paper towel and adding iodine to it. Iodine will stain your hands and clothes, so use some care when you handle it.

Step #2

Put the leaf in a test tube. Be sure the leaf used includes the covered part and some that was not covered by the construction paper. This is necessary for a comparison. Add alcohol to the test tube until the leaf is just covered.

Step #4

Heat the test tube by placing it in a 600 or 1000 m. beaker with water in it on a hot plate. YOU MUST WEAR PROTECTIVE EYE COVERS WHILE DOING THIS! Cook for 3 or 4 minutes or until leaf is bleached. Add more alcohol if you need to.

Questions:

A. What happens to the color of the alcohol? _____
   What caused this change? _____
B. What color change has occured in the leaf? _____

Step #5

Remove the leaf from the test tube and place it in half a petri dish and soak it in a small amount of iodine for 10-15 minutes.

Questions:

A. Does the entire surface turn blue-black in color? _____

B. What part, if any, did not? _____

C. Since a blue-black color is a test for starch, what inference can you make about the food-making process and the role of light?

YEAST CELL REPRODUCTION

Supplemental Activity #2

Why do this activity?

A. To observe cellular reproduction by budding in primitive plants.

B. To develop a laboratory technique of growing yeast.

C. To practice and improve microscope study technique.

D. To get some idea of the rate at which cells can reproduce and what would happen if did for a long period of time.

PROBLEM:

How do yeast cells reproduce? How long does it take them to double in number?

PROCEDURE:

This activity must be started the beginning of a class or I. S. time when you have at least two consecutive mods. ALSO, you must have at least one mod the following day to finish up in. <u>This means do not start on a Friday or day before a vacation.</u>

Fill only the rounded bottom of a test tube with the dry "Yeast And Sugar Mix". Next add water until the test tube is 2/3 full. Now shake until the yeast and sugar is dissolved. Let stand for 25 minutes. Now after 25 minutes, shake tube so that contents are evenly mixed and place one drop on a clean slide and then put a cover slip on using a large black microscope on high power (500), count the number of yeast cells in one field. _____ count. Now move the slide and count again. _____

Repeat this as many times as you can and then average all of your results. _____ is the average number of cells per field.

<u>Smell</u> the contents of the test tube.

Be sure your test tube is marked (write on tape) so you can identify it tomorrow and let it stand over night with a paper towel plug to keep out dust etc.

After 20 to 26 hours later, shake up the tube again - and repeat what you did yesterday (using the same type of microscope). Take at least 2 counts and average them. Smell it again.

#1 _____ #2 _____ #3 _____

QUESTIONS:

1. Did the smell change? _____
2. Were there more cells the second day? _____
3. How many times more cells were there the second day? _____
4. How long on the average, does it take a yeast cell to reproduce according to your figures? _____
5. What do you think could be done to speed up yeast cell reproduction? ("I don't know" is not a satisfactory answer.)
6. What might be done to slow it down?
7. For some real good extra credit - try speeding it up or slowing it down and report your results below.

SUPPLEMENTAL ACTIVITY #3

Mold Here - Mold There - Mold Everywhere - Mold - Mold - Mold

Mold spores are all around us. When they fall on a warm, moist place, they will start to grow. Home made bread will work the best because bakery bread has chemicals to prevent mold for a week or so. Give it plenty of time, two weeks or more.

When it is good and fuzzy, bring it to school and show the instructor and get his O.K. on this sheet. Now you may want to look at the mold using a microscope or stero scope.

STUDY GUIDE ACTIVITY
Supplemental Activity #5

THE NATURE OF LIFE

1. What is the difference between breathing and respiration? _____

_____

_____

2. Name the two main waste materials produced from starch. (a) ___

_____ (b) _____

3. Name the main waste material produced from proteins_____

4. List five main life processes taking place in all living organisms

(a) _____ (b) _____

(c) _____ (d) _____

(e) _____

5. Name two early scientists credited with discovery of cells.

(a) _____ (b) _____

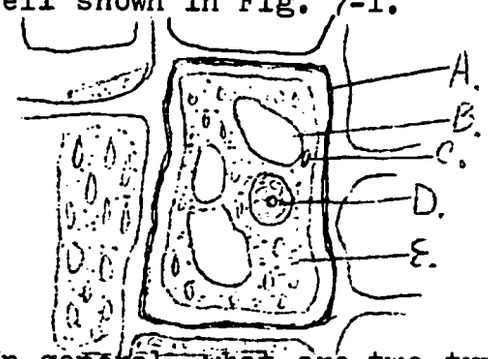
6. Give three important parts of the cell theory. (a) _____

_____ (b) _____

(c) _____

7. What kind of microscope is commonly used in the school science laboratory? _____

8. In the spaces at the right, label in the main parts of the plant cell shown in Fig. 7-1.



A. _____
B. _____
C. _____
D. _____
E. _____

9. In general, what are two types of living things? (a) _____

_____ (b) _____

10. (a) What is a group of similar cells that perform a similar activity called? _____ (b) What is a group of tissues that work together called? _____

11. What kind of organisms are the only important food producers?

_____

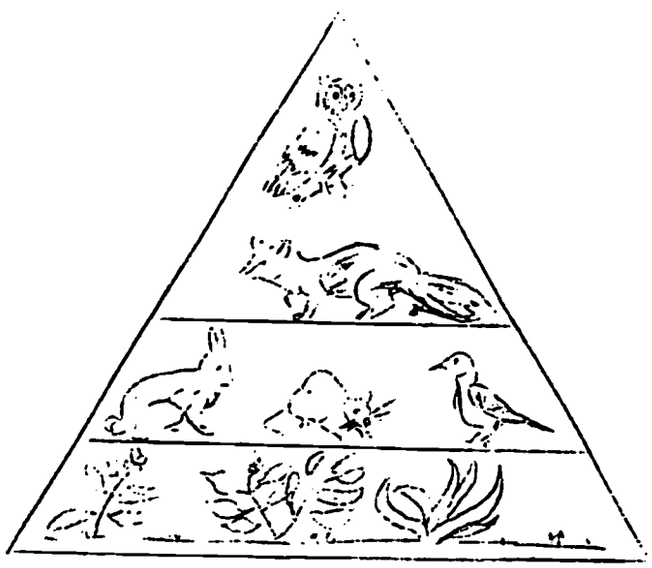
12. How does chlorophyll function? _____

_____

13. What is the source of energy in the food-making process? _____

14. What two final products are produced in the food-making process?

(a) _____ (b) _____



15. Study the food pyramid shown in Fig. 7-2. (a) Wh is the Base of the pyramid made up of green plants?

_____

(b) On what do the animals in the middle of the pyramid feed? _____

_____

(c) What kinds of animals are usually found at the top of the pyramid? _____

16. Name two other food substances made by the plant in photosynthesis.

(a) _____

(b) _____

17. What happens to energy in the process of (a) photosynthesis?

_____ (b) respiration? _____

_____

18. What cycle do the two above processes illustrate? _____

19. Why do green plants give off oxygen during the daytime but not at night? _____

_____

_____

20. What end-products are produced by digestion from (a) starch?

_____ (b) protein? _____

(c) fats? _____

21. How many parents does an organism have in which reproduction is (a) asexual? _____ (b) sexual)? _____

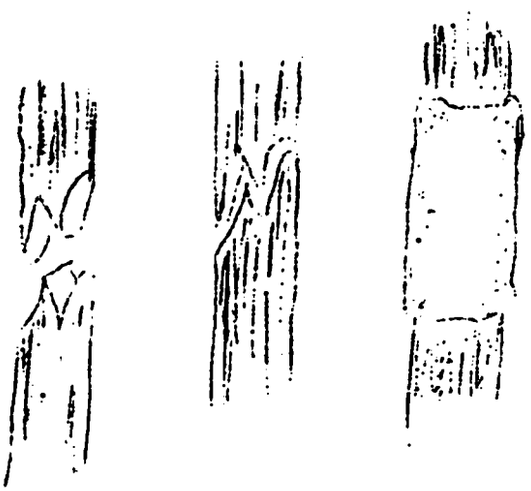
22. (a) Give an example of a simple plant that reproduces by budding. _____ (b) Given an example of a simple animal that reproduces by budding _____

23. By what means do molds and mushrooms reproduce? _____

24. List four types of vegetative reproduction in plants in which a special part of the plant produces a new plant. (a) _____ (b) _____ (c) _____ (d) _____

25. What are two methods of artificially developing new plants throug a secual means? (a) _____ (b) _____

26. (a) in the diagram in Fig. 7-3, which shows a graft on a branch on a stem, label the stock and the grafted branch. (b) Why is the grafted area sealed with wax? _____



27. Why does a grafted branch produce a different kind of fruit from the rest of the trees? _____

28. Name three animals that are able to reproduce lost parts of their bodies. (a) _____ (b) _____ (c) _____

29. (a) What is the name of the male gametes in higher forms of living things? _____ (b) Of the female gametes? _____

30. How does the amount of care given by parents to their young compare with the number of eggs produced? _____

31. What two classification groupings are used in writing the scientific name of an organism? (a) _____ (b) _____

32. In general, what is the scientific basis on which plants and animals are classified? _____

33. Why is a shark classified as a fish, while a whale is classified as a mammal? _____

34. What is meant by the environment that affects all living things?

_____

35. Name three factors of the environment that affect living organism:

(a) _____ (b) _____ (c) _____

36. (a) What is meant by the optimum temperature for an organism?

_____

(b) How do many birds react to a change in the optimum temperature? _____ (c) How do some mammals react to a change in the optimum temperature? ____

_____

37. In how wide a zone of the surface of the earth is life found?

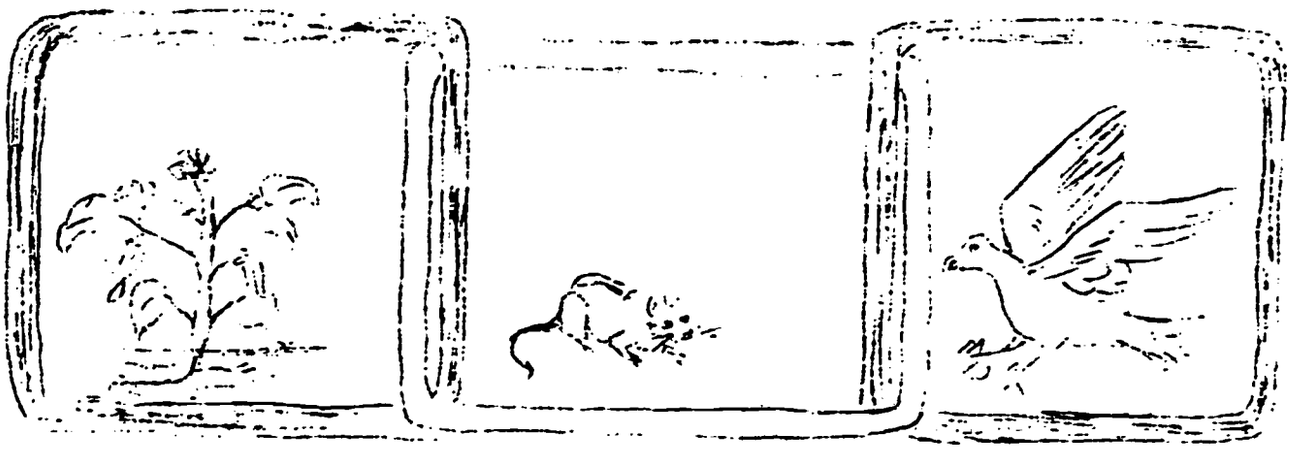
_____

38. What may happen to those organisms that are unable to adapt to changes in the environment? _____

_____

39. Fig. 7-4 shows the links of a typical food chain. (a) Which organism is the food producer? _____ (b) Which organisms are the food consumers? _____

_____



40. What do we call animals that eat only (a) plant food? _____ (b) meat? _____ (c) both plants and meat? _____

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G. A. Cunningham
Marshalltown, Iowa

T H E N O N V A S C U L A R P L A N T S
(Plants Without Pipes)

NAME _____

TEST DAY _____

SECTION DAY _____

TEXT: World of Living Things Chapter 4
Life - Its Forms and Changes, pp. 234 - 253
Modern Science I, pp. 262 - 268

Requirements:

☐ 1. Read chapter 4 of WLT, pp. 57 - 75. "Check your understanding" answer questions on pages 62-65-69-73.

☐ 2. Individual project.

☐ 3. Do "The Single Celled Algae". See page 5.

☐ 4. Now do "The Filament Algae" Lab. See page 6.

☐ 5. Write a short meaning to "The Vocabulary of Science" words on pages 74 & 75 in WLT.

☐ 6. Current sciences questions as assigned.

☐ 7. Closely examine a clump of moss and find the spore cases, bristle, leaves, and rhizoids. Make a diagram of a single female moss plant showing the spore case, bristle, leaves and rhizoids.

Supplemental Activities

Only to be done after all other requirements have been completed and approved.

☐ 1. Read in Modern Science, pp. 262-268. Complete "Review of Nonvascular Plants" on pages 6 and 7 of this L.A.P.

☐ 2. Examine the various fungi in the show case. (No paper required - We believe you).

☐ 3. Examine a clump of liverworts. Just look - don't touch! What would happen if the glass was not replaced? What is growing with the liverworts? Why? (Answer questions in writing)

☐ 4. The "Investigate" on page 70 of WLT (this one takes some time - if you plan on doing it get an early start). I want to see the eight pieces of bread, they don't need to be an entire slice. Do this at home - not in the science room!

6. "Yeast Cell Reproduction" pages 11 and 12 of "Introduction to Life Science" L.A.P. - if you have not done it yet.

.....SAVE ALL PAPERS.....

Grades: For a C - do the requirements.
For a B - do all that you do for a C plus 2 supplemental activities.
For an A - do all the requirements plus 4 supplemental activities.

Behavioral Objectives

1. Given a jar of pond water with muck in the bottom and filament aglae above and a properly equipped microscope, the student will be able to:

   a. Prepare a wet mount slide which shows single celled algae.

   b. Make a drawing of two different types of single celled algae with 70% accuracy.

   c. Prepare a wet mount slide of filament algae and stain it.

   d. Make a drawing of one cell in detail with 70% accuracy.

2. Given a collection of nonvascular plants the student will be able to separate them in groups of mosses, liverworts, and fungi with 90% accuracy.

3. The student will be able to match the vocabulary list words on pages 74 & 75 of WLT with their proper meanings on a multiple choice test with 75% accuracy.

4. Given a clump of moss and a stero microscope the student will be able to find the spore cases, bristle, leaves and rhizoids of the moss and prepare a diagram showing these parts properly labeled.

BIBLIOGRAPHY OF PLANTS

Bold, Harold C., The Plant Kingdom, Prentice, 1960

Bentley, Linna, Plants That Eat Animals, McGraw, 1967

Dupuy, William Atherton, Our Plant Friends and Foes, Winston, 1941

Fenton, Carroll Lane, Plants That Feed Us; The Story of Grains and Vegetables, Day, 1956

Galston, Arthur W., The Life of the Green Plant., Prentice, 1961

Hutchins, Ross E., The Amazing Seeds, Dodd, 1965

Hutchins, Ross E., This Is A Leaf, Dodd, Mead, 1962

Klein, Richard M., Discovering Plants, Nat. Hist. Press, 1968

Selsam, Millicent, Plants That Heal, Morrow, 1959

Selsam, Millicent, Plants We Eat, Morrow, 1955

Stefferud, Alfred, The Wonders of Seeds, Harcourt, 1956

Went, Frits W., The Plants, Time Inc., 1963

Concepts:

Nonvascular Plants

1. In plants the chlorphyll is found in the chlorplasts. (except for blue-green algae)
2. Fungi are simple plants that have no chlorphyll.
3. Plants that live on dead organisms are called saprophytes.
4. Some useful bacteria are those that cause decay.
5. Mycelium are the underground plant body of the mushrooms.
6. Mushrooms reproduce by means of spores.
7. A lichen is a combination of a fungus and an alga.
8. Lichens grow on bare rock surfaces.
9. Probably the first plants developed in ancient seas.
10. Mosses reproduce sexally.
11. Simple flat-bodied, green plants in which tracheas carry water through the plants are liver-worts.
12. Bacteria sometimes form spores to protect themselves from unfavorable conditions.
13. Diatoms are called "food of the sea" because all sea animals depend on them for food.
14. Nonvascular plants include (1) bacteria (2) fungi (3) algae (4) liverworts & mosses.
15. During fertilization a sperm cell joins an egg cell.
16. Bacteria that combines free nitrogen from the air with other chemicals to form soluble compounds are called nitrogen fixing bacteria.
17. In a lichen, the relationship between the two types of cells is called symboyant.

18. Bacteria reproduce by simple division called fission.

19. The three shapes of bacteria are: (Bocilli-rod shaped), (Cocci-ball shaped), (spinilla-spiril shaped).

20. Algae are simple green plants that have chlorphyll in their cells and always live in water.

21 Blue-green algae are the simplest forms of algae. They consist of single cells or filiments of cells and have chorphyll throughout the protoplasm.

22. Lichens help break up rocks to form soil.

A.V. Materials to be used in the Resource Center or Classroom. Check to see if they are available to you.

FILMS: 1964 - "Simple Plants - The Algae"
1968 - "Bacteria"
1827 - "Fungi"
2017 - "Origin of Land Plants - Liverworts and Mosses

FILM STRIPS:
A 448 -2 Introduction to Algae
A 465-3 Identifying Parasitic Plants
FS 487 How Plants are Classified
FS 488 Bacteria
FS 489 Fungi and Slime Molds
FS 490 Algae
FS 435 The Plant Kingdom
FS 400 Mushrooms
FS 492 Bryophytes

TAPES: WLT 4-A - pages 57 - 62 of World of Living Things
WLT 4-B&C - pages 63 - 69 of World of Living Things
WLT 4-D pages 70-73 of World of Living Things

Ecology - Introduction Part #1

Books in R. C. - paper backs

NON FLOWERING PLANTS pages 1 - 126 (very good book)

POND LIFE pages 24 - 39

Algae - pages 31 -39

Requirement 3 NAME _____

S I N G L E C E L L E D A L G A E

A single celled algae is one with only one cell or 2 to 5 loosely connected cells. They are very small and you will need to use high power to observe them. They are green to almost clear and come in many shapes and sizes.

When making your slide be careful not to get any "green hairy" stuff on your slide. It is the subject of your next Lab, and is so thick it will interfere with the much smaller single celled algae. Most of the algae you are looking for are on the bottom of the water containers, in the muck. Use an eye dropper.

Draw and label a minimum of two different types of single celled algae.

LABEL:
1. Cell Wall
2. Cell Membrane
3. Cytoplasm
4. Chloroplasts (if present)
5. Nucleus

Look up algae in several books

Make your drawings on this sheet in pencil.

Requirement 4 NAME_____

F I L I M E N T A L G A E

This type of algae is often mistaken for moss - it is not moss - moss lives on land and has rhizoids and leaves. Algae lives in water and is green and hairy. There are many kinds of filiment algae and you will only see a few of them. Label the same 5 things you labeled on the single celled algae.

Instructions:

1. Use only a few hairs. If you use too many they will be on top of one another and hard to see. Spread the algae out with the corner of the cover slip. Be sure that the algae is wet at <u>all</u> times.

2. Examine under low power and then under high power. Most likely you can not see any nuclei because they are all covered up with chloroplasts. The nuclei will become visible if it is stained with acetocarmine;
   a. remove cover slip
   b. add two or three drops of acetocarmine to the algae
   c. Place the slide on a hotplate at a low temperature (20) Be sure and leave one end of the slide sticking over the edge of the hotplate so you can pick it up without cooking your finger.
   d. Add more acetocarmine if you need to but do not allow the algae to dry up - if the slide does dry up wash it off and start over. Sorry!
   e. Remove from the heat in about a minute and replace the cover slip. If you still can not see any nuclei - cook it some more as you did before.

3. Draw one cell in detail and include an outline of the cells at either end. Make the drawing large!

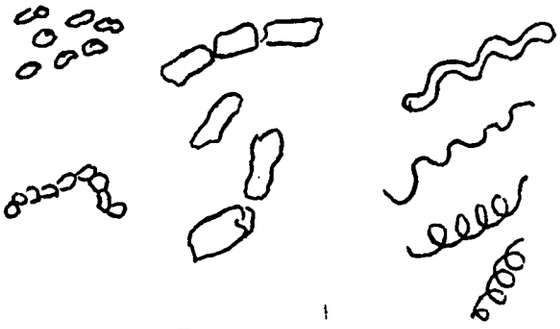
4. Label the:
   a. cell wall
   b. cell membrane
   c. cytoplasm
   d. chloroplasts
   e. nuclei (There is a very good chance there will be more than one in each cell.)

Supplemental Activity No.1 NAME_____

Review of Nonvascular Plants (pages 262-268 of Modern Science 1)

1. Name three groups of plants that include single-celled organisms.
(a)_____ (b)_____
(c)_____.

2. Fig. 9-1 shows the main shapes of bacteria. In the spaces at the right, label each kind.



A.

B.

C.

Fig. 9-1

3. What structures found in higher plants are lacking in the group that includes bacteria?_____.

4. List three ways in which bacteria are helpful to man.
(a)_____
(b)_____
(c)_____

5. What two activities of harmful bacteria may cause disease?
(a)_____ (b)_____

6. (a) If yeast is mixed with a sugar solution, as shown in Fig. 9-2, what gas is given off?_____
(b) What substance is formed in the bottle?_____
_____.
(c) What is this process in the action of yeast called?
_____

7. (a) What coloring material found in the higher plants is not found in fungi?
_____
(b) What is the name given to organisms that cannot make their own food?
_____

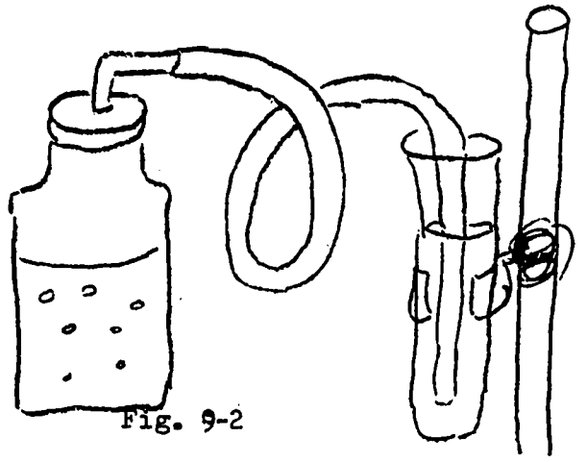


Fig. 9-2

8. (a) What are the tiny threads making up a mold called?

_____

(b) Name two disease-fighting drugs made from molds.

_____, _____.

9. In what main way are algae different from bacteria and fungi?

_____

_____

10. (a) In what way do threadlike algae, such as Spirogyra, usually produce?

_____

(b) What is the second way these algae may reproduce?_____

_____

Tell what each term means.

bacteria_____

fungi_____

molds_____

algae_____

mosses_____

Now answer the questions on the bottom of page 268 of Modern Science 1 in complete sentences on the rest of this page.

Jerry Cunningham
Ross Iverson
Marshalltown, Iowa

THE VASCULAR PLANTS

(Plants with water pipes)

NAME _____

CLASS _____

TEST DAY _____

TEXT: The World of Living Things (WLT) - Chapter 5
Harcourt Brace and World Inc.
Modern Science I - pages 269 - 276
Holt Rinehart and Winston, Inc.
Life - Its Forms and Changes - pages 274 - 305
Harcourt Brace and World Inc.

REQUIREMENTS: SAVE ALL PAPERS

- ☐ 1. Read Chapter 5 of WLT, pp. 76-101 and answer in writing the "Check your understanding" questions on pages 85-88 and questions 4,5,6,7, on page 98.
- ☐ 2. Read in Modern Science I - pp. 269-276.
- ☐ 3. Do "Seed Lab". (See page 5)
- ☐ 4. Do "Flower Lab". (See page 6)
- ☐ 5. Write out a short meaning to "The Vocabulary of Science" on pages 99-100 of WLT.
- ☐ 6. "Current Science" questions as assigned.
- ☐ 7. "Stomates Lab." See page 6½.

SUPPLEMENTAL ACTIVITIES:

Only to be done after all other requirements have been completed and approved.

- ☐ 1. Do "What Are the Higher Plants" activity on page 7 & 8.
- ☐ 2. Do "Living Chloroplast Lab." (See page 9)
- ☐ 3. Do the "Onion Root Tip Lab". (See page 10)
- ☐ 4. Seed Cone Collection. (See page 11)
- ☐ 5. Twig Collection. (See page 11)
- ☐ 6. Independent projects - see instructors.
- ☐ 7. "Seed Germination Lab". (See page 12)
- ☐ 8. "Finding Water Pipes Lab". (See page 13)
- ☐ 9. "Fern Spore Case Lab". (See page 14)

GRADES: For a C - do requirements
For a B - do requirements plus 2 supplemental activities.
For an A - do requirements and 4 supplemental activities.

SCIENCE OPEN LAB. SCHEDULE

Schedule yourself for at least 2 mods of open lab per cycle.

	I	II	III	IV	V	VI
8:35 1	HR	HR	HR	HR	HR	
9:00 2						
9:20 3						
9:40 4	O.L.					
10:00 5	O.L.			O.L.		O.L.
10:20 6				O.L.		O.L.
10:40 7				O.L.		O.L.
11:00 8						
11:20 9						
11:40 10						
12:00 11						
12:20 12						
12:40 13			O.L.		O.L.	O.L.
1:00 14			O.L.		O.L.	O.L.
1:20 15			O.L.	O.L.		O.L.
1:40 16			O.L.	O.L.		O.L.
2:00 17		O.L.	O.L.	O.L.	O.L.	O.L.
2:20 18		O.L.	O.L.	O.L.	O.L.	O.L.
2:40 19		O.L.	O.L.	O.L.	O.L.	O.L.
3:00 20	HR	HR	HR	HR	HR	HR

Behavioral Objectives

1. Given several pre-soaked seeds the student will be able to:
    a. Locate the seed coat, ovary scar or hilum and the pollen scar or micropyle with 80% accuracy.
    b. Determine if the seed is from a monocot or a dicot with 100% accuracy.
    c. Locate the plumule and radicle of the embryo plant.
2. Given a simple flower the student will be able to locate and diagram the pistil, stigma, style, ovary, stamen, filament, anther, petals, sepals, receptical, and stem with 80% accuracy.
3. Given a composite flower the student will be able to locate and diagram the same parts as in a simple flower and determine if each flower is perfect or imperfect with 75% accuracy.
4. The student will be able to demonstrate a knowledge of the "Vocabulary of Science" words by choosing the correct response to multiple choice questions with 80% accuracy.
5. Having completed the "Stomates Lab" the student will be able to prepare a wet mount slide showing stomates and diagram one of them showing epidermis cells, guard cells and the opening.
6. Have completed the "Onion Root Tip Lab" the student will be able to prepare a wet mount slide using a square technique using acitocarmine and to be able to locate three or more mitotic cells.
7. Having completed the "Seed Cone Collection" the student will be able to identify cones with 60% accuracy.
8. Having completed the "Twig Collection" the student will be able to identify unknown twigs with 50% accuracy.

Concepts: Vascular Plants

1. The fern is a plant that has rhizods, leaves and stems but reproduces by spores.
2. Seeds of trees like the pines and hemlocks are produced in cones.
3. Plants take in minerals and dissolved solids through root hairs.
4. During the first year a two year plant stores food in it's root.
5. The prothallium of the fern produces sperm and egg cells.
6. An example of an monocot is the corn plant.
7. The food part of a bean seed is called the cotyledon.
8. The transfer of pollen from one flower to the pistil of another flower is called cross-pollination.
9. A shrub is a woody plant with several more or less erect stems.
10. A corn plant has many underground roots called fibrous roots.
11. Deciduous trees lose their leaves each year.
12. In a tree, the layer of growing cells between the bark and the outer ring of wood is called the cambium.
13. Trees send out new shoots each year from their terminal buds.
14. Water is carried to the leaves of the plant through xylem tubes in the vascular bundles.
15. All plants that have flowers or cones produce seeds.
16. Grasses are nonwoody plants that do have hollow stems.
17. Leaves get rid of excess water by a process called transpiration.
18. Grass plants have parallel veins and are monocots.
19. The seeds of pine trees are found in the cones.
20. The term vascular refers to the tubes or passages found in some plants.
21. For a seed to germinate it must have water, air and warmth.
22. Not all vascular plants produce seeds.
23. Some vascular plants produce spores.
24. Dicots and monocots are both angiosperms.

Audio Visual materials to be used in the Resource Center or Classroom. Check and see if they are available to you.

Film strips:

143 Ferns and Fern Allies

145 Gymrosperms

146 Monocotyledons

147 Dicotyledons

90 Leaves of Plants

91 Flowers and Fruits

29 Flowers, Fruits and Seeds

34 Parts of Flowering Plants

Tapes:

WLT Chapter 5 - A & B pages 76-85

WLT Chapter 5 - C & D pages 85-98

Ecology - Water Pollution - Part II

Ecology - Air Pollution - Part III

Films:

1829 Gymnosperms

1932 Angiosperms - The Flowering Plants

1962 The Growth of Plants

2003 Evolution of Vascular Plants - The Ferns

SEED LAB

A. Bean or Pea Seed

1. Examine the outer seed coat of a dry bean seed. On one side you should be able to find two structures. The larger is an oval shaped scar where the seed was attached to the ovary of the flower. Just above or beneath it, you should find a smaller round structure. This is the place where the pollen tube entered the ovule before the nucleus was fertilized.

   Draw the edge view of the seed and the structures. Label the ovary scar or hilum, pollen tube scar or micropyle and seed coat.

2. Using a well soaked seed, remove the seed coats and spread the cotyledons apart. The young embryo plant can be found along the side of one cotyledon. The cotyledons contain the stored food used by the embryo to grow. Is this the seed of a monocotyledon or dicotyledon?

   Draw the cotyledon to which the embryo is attached. Label the cotyledon, plumule and radicle. Remember that the plumule will grow into the stem and leaves of the seed plant. The radicle will grow to be the roots.
   (See Transparency)

B. Corn Seed

1. Examine the outer coat of the corn seed. You may find a small pore along the top where the silk (pistil) was attached to the seed. Remember that each corn seed has developed from an ovary. The young embryo plant will lay beneath the light colored, indented area on the side.

2. Cut the soaked corn seed like this. (As shown below). . . . Find the stored food and the young embryo. The embryo has a plumule of many little white leaves folded around each other. The young radicle will be located under it. Between the embryo and the stored food is the cotyledon which absorbs foods for the young embryo to use. Is this the seed of a monocotyledon or dicotyledon?

   Draw the inside of the corn seed. Label the seed coat, stored food, cotyledon, plumule and radicle.

Cut on dotted line

(See Transparency)

FLOWER LAB

Flowers can be divided into two major groups:

1. Simple Flowers: having only one set of reproductive organs.
2. Composite Flowers: those having more than one set of reproductive organs.

A perfect flower has both male and female organs and an imperfect flower has only male or female but not both.

A. Using a simple flower such as a petunia, geranium (which can be found in the greenhouse) or a passion flower dissect it completely and make a drawing or a set of drawings that show every part and label the . . . . . .

B. Using a composite flower do the same as in part A. (Use a dandelion or a mum.) You will find it necessary to make 3 drawings, one showing the flower head in which you label the stem, sepals, receptical, and petals. Next do a ray flower and show the stigma, style, ovary, making up the pistil and the petals. If you have a dandelion you will also find the stamen consisting of the anther and filament and will be finished. If you are using a mum you will need a third drawing of the disk flower showing both male and female parts.

C. Parts to label:

1. Pistil
2. Stigma
3. Style
4. Ovary
5. Stamen
6. Anther
7. Filament
8. Petals
9. Sepals
10. Stem
11. Receptical (label on composite only)

Pistil

Stamen

OPTIONAL:

1. Ovule
2. Pollen

Name _____

Stomates Lab

Objectives: To observe stomates

Materials: Zebrina leaf

Compound microscope

Slide

Slip Cover

Water

Procedures: 1. Place one of the leaves under your microscope. Look at the back side. You should be able to see rows of stomates. If you can not see them, peel off the epidermis and make a wet mount slide.

(1) Make a drawing of the stomates and label epidermis cells, guard cells and the opening.

(2) Write a short paragraph describing the function of the stomates.

Name _____

What Are The Higher Plants
(See page 270-276 of MSI.)

1. Name two structures found on flowering plants that are not found on other plants? (a) _____

   (b) _____

2. In a flower, which part is (a) female sex structure? _____

   _____ (b) the male sex structure?

3. What carries sperm cells to the ovule? _____

   _____

4. What are the three parts of a complete seed? (a) _____

   _____ (b) _____ (c) _____

5. What part of the flower developes into the fruit? _____

6. How does it help the growth of a plant to have its seeds scattering? _____

7. Name a plant that scatters its seeds by means of

   (a) water _____ (b) wind _____

   (c) animals _____ (d) man _____

8. Define each term:

   flowering plants _____

   guard cell _____

   root hairs _____

   petiole _____

   palisade layer _____

   seed coat _____

   embryo _____

   petal _____

   sticker _____

9. Answer 5 questions on 276 of Modern Science I. Use space below for your answers.

10. Look at the plants that are available. In how many different patterns are the leaves attached to the stem. Diagram these patterns.

LIVING CHLOROPLASTS LAB.

One of the most common features of our world is green plants. Few things have more beauty than the many shades of green in the fields and forest. Usually we take this greenness for granted without stopping to wonder why plants are green.

For our first observation of living green plant cells, we will use elodea leaves, a common plant which is found in fresh-water lakes and ponds. We find it frequently in pet shops where it is sold for aquariums.

As you observe these living cells in motion, keep in mind that the green cells of elodea are similar in structure to the green cells of most plants, and that they perform a like function: food manufacture in the presence of light (Photosynthesis). The purpose of this exercise is to look inside the cells of elodea to discover where the green pigment (chlorophyll) is located.

MATERIALS: Elodea
Compound microscope
Slide and cover glass
Eye dropper

PROCEDURE:

Take one elodea from the bowl and break off one of the young leaves near the tip of the branch. Place it upside down in a drop of water on a slide and put on a cover glass.

When you look at this slide under low power, you will see that some cells seem to be packed with small green objects. These objects are chloroplasts.

(1) What is the difference in function between the green and non-green cells?

If the slide has been properly prepared you will be able to see the chloroplasts moving. As they move, chloroplasts look like little green beads in a chain--one after the other. They move slow, so it may take a minute to notice.

When you find a cell showing moving chloroplasts, observe it under high power.

(2) What is the shape of a single chloroplast?

(3) In what part of the cell are the chloroplasts found?

Chloroplasts have no means of independent movement--they cannot swim around on their own.

(4) How and why are they moving?

(5) Make a drawing of the elodea cell. (large) Label the chloroplasts and draw arrows indicating their direction of movement.

Supplemental Activity 3 10

Onion Root Tip Lab

Final O.K. _____

The objective of this lab is to see the cells that are dividing in the growing root tip. It is hoped that you will be able to see the different stages of the nucleus as it is going through mitosis. Look up "mitosis" in one of your texts so you will know what it is you are looking for.

There are no drawings required but the instructor must check and approve of your slide. You may draw on this sheet if you like. Answer the questions at the end.

Use onion root tips. Ask the instructor. If they are not available you will need to grow some.

1. First examine the out-side of the root tip.
2. Next place the end one-fourth inch of the root tip on a slide and add two drops of acetocarmine.
3. Place the slide on a hotplate until only a small amount of liquid remains. Do not allow the slide to dry up. If it starts to boil remove it and allow to cool for a few moments and replace it.
4. Add another drop of acetocarmine and reheat.
5. Add another drop and reheat.
6. Add a drop of H_2O.
7. Place a cover slip on slide and squash it down flat with your finger. Next slide the cover slip around a little to spread out the root tip. Be gentle.
8. Look first under low power and then under high looking for fingers like those shown on the wall chart or in the text books.
9. Have the instructor check your slide.

O.K. of slide _____
Date _____

Question:

Which phases of mitosis can you observe in your slide?
(See pages 46 & 47 of General Zoology or Botony pages 43 or 46.)

A _____ Instructors O.K. _____
B. _____ Instructors O.K. _____
C. _____ Instructors O.K. _____
D. _____ Instructors O.K. _____
E. _____ Instructors O.K. _____

Supplemental Activity 4

Seed Cone Collection

1. Collect at least 6 different kinds (or more) of cones from Gemnosperms (ever greens).
2. Identify them.
3. Mount them for display and bring them to school to be checked.

Books that will help:

a. TREES Golden Nature Guide pages 15-35

b. Any book on tree identification

Supplemental Activity 5

Twig Collection

1. Collect at least 6 different kinds (or more) of twigs. (no leaves just the twigs).
2. Identify them.
3. Mount them for display and bring them to school to be checked.

Books: TREES Golden Nature Guide

SEED GERMINATION LAB

This activity will take at least a week (7 days) so allow time for it. The objective of this activity is to determine which factors affect seed germination. A seed can be thought of as a plant waiting for a place to grow and germination as what happens first when the seed finds a place to grow. Possible factors which would effect germination are light, heat, moisture and oxygen. Your task should you decide to take this mission - will be to determine what are the important factors in seed germination. And finally make a statement stating the ideal conditions for seed germination.

To do this you will need some seeds (radish or bean), paper towels, a refrigerator, water and some containers. You will need to supply your own containers. You may do this at home or at school - be sure each of your containers are clearly marked. You will need to run four tests at the same time so you will need four identical containers. For each test use ten seeds.

PROCEDURE:

(1) Fold the seeds in 4 paper towels (10 in each towel). Label them as follows:
   (1) wet - warm
   (2) wet - cold
   (3) dry - warm
   (4) dry - cold

(2) Moisten the towels used in packet 1 and 2. Leave the towels of packets 3 and 4 dry.

(3) Place all packets in their respective containers.

(4) Place the containers holding packets 2 and 4 in the refrigerator; place packets 1 and 3 in a warm place (room temperature).

After 5 - 7 days fill in the chart below and answer the questions asked. If you do this at home bring the packets to school to show your instructor the results.

Fill in the chart with the number of seeds in each test which germinate (start growing).

	Warm	Cold
Wet		
Dry		

(1) Have you proven that seeds can germinate with air present? _____

(2) Have you proven that a seed can germinate without air? _____

(3) What have you proved about a need for light or darkness? _____

(4) Do seeds need warmth to germinate? _____

(5) Do seeds need moisture to germinate? _____

(6) Which seeds germinated the best? _____

FINDING WATER PIPES LAB.

We are now studying vascular plants, that is, plants with water pipes. You may want to see and study these tubes. To do this, celery can be used.

A. The first thing to do is set the celery stock with leaves in colored water[1] and allow it to set over night or longer. Now examine the stalks or stem. What changes have taken place?

B. Next take a short piece of the stem and split it lengthwise[2] and look at it under a disecting stereoscope. Sketch one or two of the tubes that you split open.

C. Now take and cut a very, very thin cross section of the stem and examine it under a compound microscope. (See diagram 2 on page 140 of LIFE). Sketch and label the pattern of water tubes.

D. Now get a small piece of stem from a dicot (ask the instructor) and make a cross-section slide as you did with the celery and sketch and label the water tube pattern you see. (See Fig. 24.10 on page 335 of Modern Biology.)

1 You may color the water with ink or fruit coloring.
2 See page 140 of Life diagram 3 for more information on how to cut the stalk.

FERN SPORE CASE LAB.

Ferns are the only group of vascular plants to reproduce by spores The others use seeds. You know from past experience that seeds are dispersed in many ways. Some seeds are carried off by the wind like the milkweed, or birds carry poison ivy seeds, or by water, and in animal fur. The spores are very tiny and do not move except by wind, water, and a "spring snapper". When the air is moist the spore cases which contain the spores, spring open. The edge of the spore case opens up and acts as a coiled spring to propell the spores out into the world.

In this activity you will be looking at a fern leaflet and seeing the springed spore case and some spores. Look at the diagrams on page 78 of WLT.

A. From an instructor, get a fern leaflet and examine it. Notice how the edges are curled up some places - these still have the spore cases in them. Those that are open and fuzzy on the back have already dispersed their spores.

B. Now take a clean slide and place the leaflet on it and smash part of it with your finger and you will notice little black granules - these are the spore cases. Use a microscope to examine them. Sketch one of the spore cases and label the "spring".

C. Next add water and a cover slip. Smash the cover slip down to force the spores out. Take a good look and have your slide checked by an instructor. SLIDE CHECK _____

You may want to take a slide of spore cases and add water and heat them to see if you can make them snap open.

R. L. Iverson
G. A. Cunningham
Marshalltown, Iowa

ANIMALS

NAME _____

TEST DAY _____

SECTION NO. _____

TEXTS:

THE WORLD OF LIVING THINGS (WLT)

LIFE: ITS FORMS AND CHANGES (LIFE)

MODERN SCIENCE I

REQUIREMENTS:

- ☐ 1. Study pages 120-193 in WLT and answer the "Check Your Understanding" questions on page 138.
- ☐ 2. Study pages 281-304 in Modern Science I.
- ☐ 3. Look over pages 307-421 in LIFE.
- ☐ 4. Write a short meaning to the vocabulary terms in behavioral objectives on page 3 of this lap.
- ☐ 5. Fill in the "Invertebrate Life Processes" chart page 9 of this lap.
- ☐ 6. Do the Protozoan Lab. See page 10 of this lap.
- ☐ 7. Do the Worm Disecting Lab. See pages 11, 12 & 13 of this Lap.
- ☐ 8. Study Chapter 9 of WLT pages 162-191 and complete the "Vertebrate Self Test on pages 14 and 15 of this lap.
- ☐ 9. Fill in the "Vertebrate Life Processes Chart" on page 16 of this Lap.
- ☐ 10. "Frog Disecting Lab" pages 17,18,19 & 20 of this lap.
- ☐ 11. Current Science as assigned.

SUPPLEMENTAL ACTIVITIES:

- ☐ 1. Answer the "Check Your Understanding" questions on pages 123 & 124, 127 and 132.
- ☐ 2. Answer the "Check Your Understanding" questions on pages 150 & 151 and 157.
- ☐ 3. Make a pond or stream water aquarium. See page 21.

4. "Examining a Crustacean" Lab. See pages 144 and 145 of WLT and page 366 of Life. You may use Ostracods or Cyclops, if you can't find Daphnia.

5. "Learning About Coral Formations". See pages 138 and 139 of WLT, you may want to see an instructor or go ahead on your own.

6. Become an authority on one animal and write a report including habitat, habits, food, and life story. This is an Independent Project.

7. Student Activity on page 302 of Modern Science I -- bring your own feather or get one from a friend. Also see page 405 in LIFE.

8. Independent Projects (your own pets?) See an instructor.

For a C---Do all requirements

For a B---Do all requirements plus any 2 supplemental activities

For an A--Do all requirements plus any 4 supplemental activities

BEHAVIORAL OBJECTIVES

1. The student will be able to demonstrate a knowledge of the below "vocabulary of science' words by choosing the correct response to multiple choice questions with 80% accuracy.

amphibians	protozoans	compound eye
arachnids	regeneration	trachea
arthropods	reptiles	thorox
coelenterates	vertebrates	diaphragm
crustaceans	protozoa	placenta
invertebrates	esophagus	ventral surface
mammals	mollusk	dorsal surface
metamorphosis	annelid	primates
metazoans	gizzard	marsupial
mollusks	exoskeleton	parthenogenesis

2. Having completed supplemental activity No. 3 and given water, mud, algae, dead leaves and small rocks from a pond or stream a student will be able to prepare a pond or stream acquarium and identify 80% of the life therein.
3. Using various textbooks and other sources the student will be able to prepare a chart showing the life processes of the invertebrate and vertebrates.
4. Given an earthworm, disecting kit, hand lens and binocular microscope a student will be able to locate and describe the following parts of the earthworm with 80% accuracy.
   A. Exterior Features pp 11
   B. Internal Features pp 12
   C. Digestive System pp 13
   D. Nervous System pp 13
   E. Excretory System pp 13
   F. Circulatory System pp 13

5. Given a preserved frog and a disecting kit the student will be able to find and identify the following frog organs with 80% accuracy.

   A. Organs of the mouth. See page

   B. Internal organs. See page

   C. Exterior parts. See page

6. The student will learn the concepts as stated on pages of this packet so that he may pass a multiple choice test over them with 80% accuracy.

FILMSTRIPS:

1. "How Animals are Classified" 1361
2. "Simple Animals" 1362
3. "Worms, Mollusks and Spiny-Skinned Animals" 1363
4. "The Joint-Legged Animals" 1364
5. "Fish and Amphibians" 1365
6. "Reptiles and Birds" 1366
7. "Mammals" 1367

FILMS:

The following films will be available for viewing during open labs in room C-2 on the dates indicated.

Jan. 4-8 inclusive

1908-F Echinoderms-sea stars and relatives

1946-F First many-celled animals - sponges

1956-F Stinging celled animals - coelenterates

Jan. 8-13 inclusive

1902-F Segmentation-Annelid worms

2033-F What is a Fish?

Jan. 13-21 inclusive

1858-F What is a Reptile?

1966-F Which is a Mammal?

TAPES:

WLT - pages 120-140 Soft Bodied Invertebrates

WLT - pages 141-161 Invertebrates with Jointed Legs

WLT - pages 162-191 Vertebrates-Animals with Backbones

Modern Science I Pages 281-304 Invertebrates & Vertebrates

CONCEPTS:

1. Single-celled animals are organized within a single cell to carry on their life functions.
2. Arthropods are the most successful phylum of the invertebrates.
3. Insects, the most numerous class of organisms, exhibit a wide variety of adaptations in body structures fitting them for carrying on their life functions in a wide variety of environments
4. Animals are classified by recognized likenesses and differences in body structure.
5. All segmented worms are classed as Annelida.
6. Many Pacific Islands and the Great Barrier Reef of Australia were built by corals.
7. The simplist organism in which the cells are differentiated into a head with eyes and a food tube is the Planaria.
8. The characteristics of animals that have two sides alike in structure are considered to have bilateral symmetry.
9. The characteristics of animals whose similar body parts radiate out from the center are considered to have radial symmetry.
10. The union of a sperm cell and an egg cell is called fertilization.
11. The process by which eggs develop without fertilization is called parthenogenesis.
12. If one animal produces both eggs and sperm cells, it is a hermaphrodite.
13. The eggs of a moth or butterfly hatch into a caterpillar or larva.
14. During complete metamorphosis, an insect larva changed into a pupa.
15. Moths and butterflies are commonly known as scale-winged insects.
16. The insects body is divided into three main parts, the head, thorax and the abdomen.

17. The wings and legs of insects are attached to the thorax.
18. The plankton of the sea is made up mainly of diatome and copepods.
19. The first animals to have a body cavity, a solid nerve cord, and a closed blood system are the segmented worms.
20. The growing of a new structure by a organism to replace a lost one is regeneration.
21. The arthropods have an exoskeleton. (skeleton on the outside)
22. The chief characteristic of vertebrates is a body framework, centered around the spinal column, which supports and contains the organs.
23. Fish, amphibians, and reptiles are cold-blooded vertebrates that are able to adjust their body temperature to changing physical conditions in the environment.
24. Any animal that feeds its young on milk is a mammal.
25. The kinds of fish known as sharks and rays have cartilage skeletons.
26. At some stage in their embryo development, all mammals have gill slits.
27. The whale is the largest of the mammals.
28. The two warm-blooded classes of vertebrates are the mammals and birds.
29. Man belongs to the most highly developed order of mammals called the primates.
30. In all vertebrates, the backbone is located in the dorsal surface.
31. A bird's bones are hollow and filled with air.
32. The first vertebrates adapted to spend some part of their life on land were the amphibians.

33. The first true land vertebrates were the reptiles.

34. The structure that makes a fish go up or down in the water is his air bladder.

35. Fish have a two chambered heart.

36. Amphibians have a three chambered heart.

37. Reptiles have a four chambered heart with an opening between the ventricals.

38. The vertebrates that have a perfect four chambered heart are the birds and mammals.

39. In most mammals, the young are nourished inside the mother's body through the placenta.

40. Most mammals produce very tiny eggs without shells.

Requirement No. 5

LIFE PROCESSES CHART OF
INVERTEBRATES

Animal	Ingestion	Digestion	Respiration	Reproduction	Excretion
Protozoans					
Sponges					
Flatworms					
Roundworms					
Mollusks					
Echinoderms					
Arthropods					

REQUIREMENT #6

PROTOZOAN LAB

As you should know by now protozoa are single celled animals. They eat mainly algae and each other and then larger animals eat them. The protozoans are primary consumers and an important link in most water communities food chains. In this lab you are to examine many different types of protozoa that can be found in any of the water containers in the room. The slime on the end of the big aquarium is a good place, or the skum on the top of a jar or the junk on the bottom. You will find very few swimming free in the clear water.

Protozoa are grouped by the way they move into three classes:

1. Flagellates 2. Pseudopods 3. Cilliates

To complete this activity you need to draw a representative of two classes of protozoa in detail. You may need to slow them down a little; and stain them for better visability. Iodine, acetocarmine, and carmine red are things that may help. You will need to use the highest magnification you can get. Be sure to use a cover slip and not too much water on your slide. Make the drawing large.

For further help read in:

Pond Life pages 74-76

Life pages 308-314

How to Know the Protozoa - the entire book.

<u>Keep your slide until you have your drawing O.K.'d or be prepared to make a new slide!!!</u>

REQUIREMENT NO. 7

YOU NEED A PARTNER FOR THIS
(Limited number of worms)

EARTHWORM - A Segmented Worm

Phylum Annelida - Means "little rings"

Class Oligochaeta - Means "few bristles"

I. Exterior Features - See page 343 of LIFE

Examine an entire worm in water. Locate the following parts. A hand lens or binocular microscope may help to find some of them. The underlined words are the most important ones to know.

A. Notice that the worm is divided into segments or somites. Count the number of somites in yours and report it on the blackboard. Do not count the lip. (See diagram.)

B. Anterior - means toward the head; pointed end of worm

Mouth - small opening at pointed end.

Lip - fleshy projection over the mouth.

Clitellum - smooth swelling over several somites. Secreates the cocoon eggs are laid in.

C. Posterior - means toward the tail end; flattened end of worm

Anus - opening in flattened end - solid waste products of digestion are given off through it.

D. Dorsal Surface - means upper or back surface; darker, upper surface of worm, has a blackish line running down the middle.

Dorsal pores - small, in middle of back on furrows between the somites - connects each segment with the exterior

E. Ventral Surface - means bottom or stomach surface slightly flattened on worm.

Setae - small bristles on each somite - run your finger along them. Used for movement.

Oviducts - 2, small ventral on somite 14 - eggs are released through these openings.

Sperm releasing pores - 2, ventral, on somite 15 - releases sperm to fertilize eggs.

Sperm receiving pores - 2 pairs, small lateral between 9 - 10 and 10-11 - receives sperm from another worm during mating.

Excretory pores - 2 per somite, small, ventral but up on the side - liquid waste is given off from each somite.

F. Notice that if you would split the worm from mouth to anus, each half would be a mirror image of the other. This is called _____ symmetry.

II Internal Structure - See pages 344,345 and 346 of LIFE

A. Cut across the specimen about 1 inch behind the clitellum; keep all parts of the worm until the exercise is completed.

B. From the posterior part cut off 2 or 3 somites and examine the crossection. The body is essentially one tube (body wall) surrounding another (digestive tract) the space between contains various organs and is divided by thin walls (septa). The dorsal fold within the intestine increases the amount of surface food can be absorbed through.

C. Holding your worm with dorsal side uppermost (recognized by dark line of dorsal vessel) and using sharp scissors, cut forward through the dorsal body wall only, just to the left of the mid-dorsal line to about somite 4; keep the point of the lower scissor blade from damaging internal organs. Pin down the specimen by the posterior end, placing the worm near the edge of the disecting pan or pad. Beginning posteriorly grasp the cut edges of the body wall with forceps and use a needle to release the thin septa from their attachments to the digestive tract. Keep the blackish dorsal vessel uppermost; loosen the septa equally on the two sides. As the body wall is spread, fasten it down with pins along the margins; place pins, slanting outward, in each side of somites 20, 25, 10 and 5 for convenience in referring to organs. Finally cut and spread somites 4 to 1. Wash away any coagulated debris around the organs with water from an eyedropper.

NEATNESS

COUNTS

D. Locate the following organs:
Digestive System:

Mouth Cavity - just behind mouth - receives food

Pharynx - swollen, with external muscle fibers - somites 4 - 5

Esophagus - slender, hidden under sperm storing organs and heart.

Crop - large, spherical, thin-walled somites 15 - 16 stores food.

Gizzard - large, thick muscular walls, somites 17 - 18 grinds food up and digestive juices are added

Intestine - somite 19 to anus

Nervous system:

Brain - 2, small white lobes, dorsal in somite 3 over mouth cavity

Nerve cord - whitish band on ventral surface under the digestive system.

Sperm storing organs - 2 pairs, large, soft, somites 9 - 13 - stores mature sperm until mating

Ovary - egg producing organ - may be found on bottom of body cavity sometimes.

Excretory System:

Kidneys - 1 pair per somite, small white coiled tubes - collect liquid wastes and release through as pore to the outside.

Circulatory System:

Hearts - 5 pairs, lateral to esophagus, somites 7 - 11 darkened by blood.

Dorsal blood vessel - over digestive tract; filled with blackened blood.

When you have found everything you can have an instructor check you out on it.

VERTEBRATE SELF TEST

REQUIREMENT #8

1. Name the five main classes of vertebrates.
   (a) (b)
   (c) (d)
   (e)

2. List five general body structures seen in most bony fishes.
   (a) (b)
   (c) (d)
   (e)

3. What are some ways in which fish are important to man?

4. What does the name "amphibian" mean?

5. List four general body structures seen in most amphibians.
   (a) (b)
   (c) (d)

6. In what way are most amphibians useful to man?

7. In what three ways is a frog adapted to carry on respiration?
   (a)
   (b)
   (c)

8. List two general body structures seen in most reptiles.
   (a)
   (b)

9. Name four poisonous snakes found in the United States.
   (a) (b)
   (c) (d)

10. In what way are most snakes useful to man?

11. List two general body structures seen in most birds.
    (a)
    (b)

12. How do feathers help a bird control its body temperature?

13. What are some of the ways in which birds are important to man?

14. List three general body structures seen in most mammals.
(a)
(b)
(c)

15. How are mammals in each of the following orders generally helpful or harmful to man?
(a) flying mammals

(b) gnawing mammals

(c) hoffed mammals

(d) meat-eating mammals

Tell what each term means:

hibernation:

estivation:

migration:

VERTEBRATE LIFE PROCESSES CHART

REQUIREMENT #9

	Ingestion	Circulation	Respiration	Excretion	Reproduction
Fish					
Amphibians					
Reptiles					
Birds					
Mammals					

REQUIREMENT #10

(You need a partner)

FROG LAB

The frogs are preserved in formaldehyde; it will kill the skin on your hands if you do not keep them moist with some kind of handcream. Bring your own hand creām. Formaldehyde will also burn your nose and eyes if they come in contact, therefore, it is a good idea to wash your frog off with water. In fact, wash it twice..... This washing will make it much more pleasant to work with.

When you are finished for the day, pin your frog back together and tie a tag of paper to it with your number or name on it written with a wax pencil only, ink will fade away. Now place it in the container with your class number on it so you can find it when you come back. Then wash and hand dry all tools you have used; replace them all.

On this part you must work in groups of at least two and no more than three unless instructed differently. Do not discard your frog until after you have taken the test.

PART ONE

EXTERNAL FEATURES. Using a fresh or preserved frog, identify. See pages 97-99 of LIFE.

Head (to behind eardrum)
Trunk (remainder of body)
Snout (region anterior to eyes)
Mouth
Anus or cloacal opening (dorsal at end of body)
Fore limb (upper arm, forearm, hand, wrist, 4 digits or fingers)
Hind, limb (thigh, shank or lower leg, ankle, foot, 5 digits or toes, webs)
Nostrils or external nares (2, small, on snout)

Eyes, each with upper eyelid (fleshy) lower eyelid (narrow)
Nictitating membrane (large thin eyelid, inside other two)
Cornea (transparent surface of eye)
Iris (colored)
Pupil (opening in iris)
Tympanic membranes or eardrums (behind eyes)

Make any drawings you need to help you remember.

The innermost digit of each hand is enlarged in males.

Mouth cavity. Open the frog's mouth widely by bending the lower jaw far back, cut the muscle at the corner of the mouth. Wash out any mucus present.

Find the following:

Roof of Mouth Cavity

Mamimlary teeth (on upper jaw, many, minute)
Vomerine teeth (2 small patches, between internal nares)
Internal Nares (2 anterior openings, connect to external nares)
Openings of Eustachian tubes (2; at corners of mouth, each connects to cavity of middle ear under eardrum)

Would a drawing help you remember? Floor of Mouth Cavity

Tongue
Openings to vocal sacs (2; lateral; present only in males)
Pharynx (posterior part of cavity, behind tongue)
Clottis (lengthwise slit in ventral wall of pharynx)
Esophagus (posterior to pharynx)

Draw again!

PART TWO
INTERNAL ANATOMY

See pages 97 - 102 of LIFE. (very good diagram)

A. Lay the frog on its dorsal and cut the skin with a scissors, from posterior to anterior just to the right of the mid-ventral line. There is a large vein just under the skin that should not be broken. The cut should go from between the hind legs to the front of the lower jaw. Now cut perpendicular to each leg. Lay the skin back carefully and pin it. Now cut the abdominal muscles the way you did the skin. Be careful not to mess up the insides with the scissor point. Cut the heavy muscle and bone between the front legs so they may be spread out.

If your frog is a female it may be so full of eggs that you can see nothing else. Examine the eggs and carefully remove them. Use what pins you need to hold the frog open.

B. Internal organs. Beginning anteriorly, and using only the forceps and probe, identify:

Heart (reddish, conical, muscular, enclosed within a delicate membrane, the pericardial sac)
Lungs (2 dorsal to liver, soft, thin-walled, often shriveled)
Liver (large, firm reddish brown, of 3 lobes)
Gall bladder or bile sac (thin spherical greenish sac between middle and right lobes of liver)
Stomach (long, whitish, along left side, dorsal to liver)
Small intestine (yellowish or grayish, slender, irregularly coiled)
Large intestine or rectum (dark, passes into pelvic girdle)
Spleen (small, spherical, dark reddish, posterior to stomach)
Kidneys (2, elongate, dark brown, on dorsal wall above peritoneum)
Fat bodies (2, soft, finger-like lobes, yellowish, attached anterior to kidneys)
Ovaries (2, in female, long, wavy, whitish, along either side of mid-dorsal line)
Testes (2, in male, bean-shaped, pink or yellow, at antero-ventral ends of kidneys)
Digestive system A. This system is composed of the digestive tract or alimentary canal and its associated glands. It prepares food to be absorbed into the body. Identify the following parts, beginning anteriorly.

DIGESTIVE TRACT

It may be time to draw -- two or three
Mouth and mouth cavity with tongue and teeth (Exercise 4)
Pharynx (behind mouth cavity)
Esophagus (short, dorsal to heart; insert probe through pharynx to stomach to locate)
Stomach (whitish; large; anterior or cardiac and small; posterior or pyloric and larger with constriction or phyloric valve at end)
Small Intestine (short anterior loop beside stomach is duodenum and receives bile duct; remainder is ileum)
Large Intestine (dark; connects to cloaca)
Cloaca (within pelvic girdle; common end of digestive, excretory and reproductive systems; see Exercise 8 for details)
Anus

DIGESTIVE GLANDS

Pancreas (irregular flattish glandular tissue, yellowish whites; between stomach and duodenum)
Liver and gall bladder

What is the function of each of the organs in the digestive system?

SUPPLEMENTAL ACTIVITY NO. 3

MAKE AN AQUARIUM

See page 311 in LIFE for some ideas.

Make a pond or stream water aquarium. Include in the aquarium, water, mud, algae, dead leaves and small rocks. Use your own jar and bring it to school for inspection. On this piece of paper tell the location at which you collected the material. Keep this paper in your notebook after it has been approved. Be sure your jar is marked. If two of you work together make two aquariums. No two people will receive credit for the same jar. You will be able to take these home and watch them grow.

What kind of life is in your Aquarium? (Be prepared to "show me"!) Use Life in a Pond book and a microscope.

R. L. Iversen
G. A. Cunningham
Marshalltown, Iowa

THE SKELETAL AND MUSCULAR SYSTEMS

NAME _____

Sec. No. _____

Text: Modern Health

World of Living Things

Requirements:

- ☐ 1. Study pages 244-265 of Modern Health and answer #1, 19, 21, 22, 23 on pages 264 and 265.
- ☐ 2. Study pages 266-277 of WLT.
- ☐ 3. Human Skelton Sheet
- ☐ 4. Self Check Test on the Skelton.
- ☐ 5. Human Muscles Sheet
- ☐ 6. Self Test over Muscles.

Supplemental Activities:

- ☐ 1. Frog Skeleton Lab. (See page 12)
- ☐ 2. Frog Leg Muscle Lab. (See page 13)
- ☐ 3. Examine frog leg muscle fiber under high power. See activity on pages 274-275 of WLT. Be sure an instructor sees your slide under the microscope.
- ☐ 4. Independent Projects -- see instructors.
- ☐ 5. Care of Science rooms -- see instructors.
- ☐ 6. Make a report on a library book about the bones or muscles.
- ☐ 7. Answer all 10 "Check Your Understanding" questions on page 273 of WLT.
- ☐ 8. The Effect of Temperature on Muscular Contraction. (See page 14)
- ☐ 9. The Effect of Fatigue on a Muscle. (See page 15)

Grades:

For a C - do requirements
For a B - do requirements plus 2 supplemental activities.
For an A - do requirements and 4 supplemental activities.

1. The student will be able to locate the bones and joints listed in Supplemental Activity #1 on the leg of a frog with 80% accuracy.
2. Given a diagram of the human skeleton the student will be able to identify the bones of the body, as listed in requirement #6 with 80% accuracy.
3. The student will be able to identify in writing examples of ball and socket, hinge, gliding and immovable joints.
4. The student will be able to locate and identify the muscles on the muscle worksheet in requirement #4 with 80% accuracy.
5. The student will be able to demonstrate in writing at level of 80% accuracy the difference between voluntary, involuntary and cardiac muscle.
6. The student will be able to demonstrate in writing the difference between insertion and origin of the muscle.
7. Given a leg of a frog, the student will be able to demonstrate the location of the following items:

a. Triceps femoris	e. Gastrocnemus
b. Sartorius	f. Tibialis Anticus
c. Gracilis	g. Tibialis Posticus
d. Extensor cruris	h. Achilles tendon

TAPES:

1. WLT - Chapter 13 -A-B pages 266-277.
2. Modern Health - Bones - pages 244-257.
3. Modern Health - Muscles - pages 260-263.

Skeletal System Concepts

1. The skeleton protects organs of the body, provides body shape, and enables one to move (joints).

2. There are three main kinds of joints formed where bones connect:

   A. Ball and socket joints are located in the shoulder and hip.
   B. Hinge joints are located in the elbow and knee.
   C. Semi-movable joints are found where ribs attach to the spinal column.

3. Joints are lubricated by a substance called synovial fluid.

4. The Bursa membrane forms a cushion between joints.

5. Cartilage is found throughout the body. It gives parts of the body shape and support, e.g., ear and tip of nose.

6. The large bones of the body (leg) have a hollow center called marrow. In this bone marrow, the blood corpuscles are always formed.

7. The bones are covered by a tough membrane called the periosteum which furnishes the nourishment for the living bones.

8. Ligaments join and hold bone to bone.

9. Tendons connect bones to muscles.

10. Major bones of the body:

    A. Mandible and maxilla are the jaw bones.
    B. Cranium is the head or skull.
    C. Scapula or shoulder blade.
    D. Humerus is the large bone in the upper arm portion.
    E. Radius and ulna are the bones of the forearm which join to the wrist.
    F. Cervical vertebrae are the seven bones of the neck.
    G. Thoracic vertebrae are the twelve vertebrae of the upper backbone.
    H. Lumbar vertebrae are the five vertebrae of the lower backbone.
    I. Pelvic or hip bones form the pelvic girdle.
    J. Femur is the large bone of the upper leg.
    K. Tibia and fibula are the two bones of the lower leg.
    L. Coccyx is the end of the backbone..
    M. Ilium, pubis, and ischium are the bones which make up the pelvic girdle.

HUMAN MUSCULAR SYSTEM CONCEPTS

1. There are three kinds of muscles according to their function and shape.

   A. Voluntary (striated) muscles which you are able to control - eg., arm, leg, head, etc.
   B. Involuntary (unstriated or smooth) muscles which you cannot control - eg., lungs, etc.
   C. Cardiac muscle tissue is located in the heart.

2. Muscle parts: (A) Belly is the body or fleshy part of a muscle; (B) Origin of the muscle is connected to tendons and remain stationary during movement; (C) Insertion - is the muscle connection to the movable body parts, eg., elbow joint.

3. Skeletal muscles (voluntary) and their two functions (A) flexors are muscles which bend joints (B) extensors - straighten out - eg., biceps and triceps of the elbow.

4. Major muscles of the body and their functions in movement.

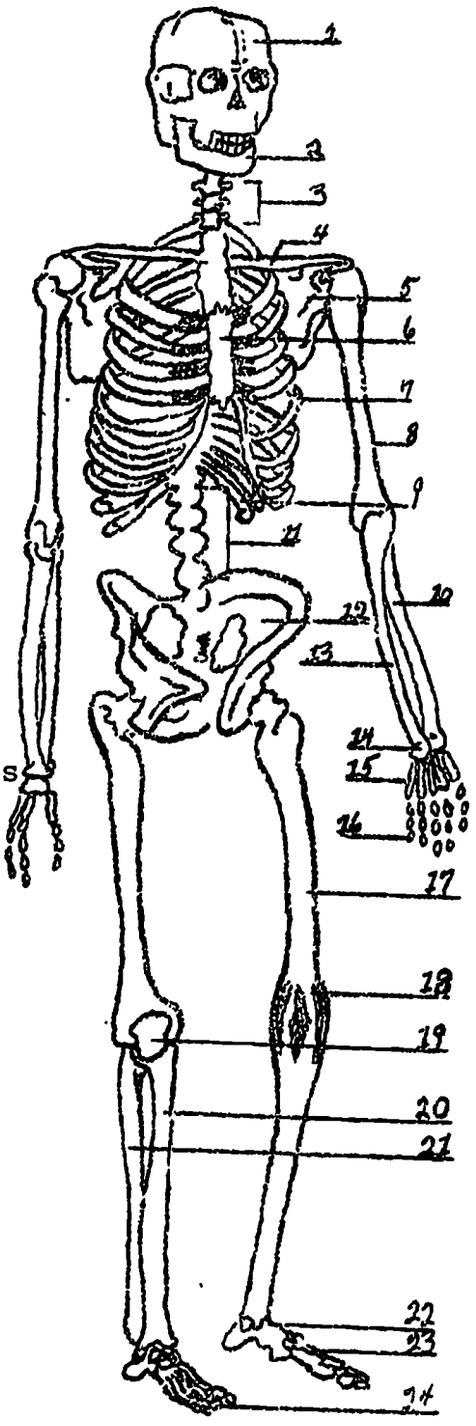
   A. Biceps - large muscle located on the front of upper arm which flexes (bends) the elbow when it contracts.
   B. Triceps - muscle located on reverse (back side) from the biceps and straightens the arm out while the biceps relaxes and vice-versa.
   C. Deltoid - large shoulder muscle which raises and lifts the whole arm.
   D. Trapezius - very large back muscles which raise shoulder and arm up and backward in a rotation type motion.
   E. Pectoralis - chest muscles which pull arm and shoulder in toward the body.
   F. Latissimus Dorsi - muscles running from the back, around the side of the body and underneath the arms which pull the arm down and back and rotate the trunk of the body.
   G. Rectus Abdominis - is a wide sheath of abdominal muscles which protect the abdominal organs and pull the body forward eg., touch one's toes.
   H. Quadricepts - large muscles located on the front (thigh) of the leg and pull the leg upward and forward - eg., kicking a football.
   I. Biceps Femoris - is the muscle which flexes or bends the knee.
   J. Tibialis Anterior - pulls the foot upward and slightly laterally.
   K. Gastronemius - (calf muscle) is the large lower leg muscle which extends the foot and connects with the achilles tendon and the heel - eg., stand on toes.
   L. Gluteus Maximus - the muscles which protect and move the buttocks.

5. Muscles produce movement by contraction. Muscles have the ability to pull in one direction. Therefore when one muscle pulls the opposite muscle must be relaxed. Most muscle injuries are due to muscles not being relaxed - eg., pitcher warming up.

6. Muscular coordination is the ability of the various 600 body muscles to respond in harmony with the nerve impulses. Therefore, skill is developed - eg., throwing, running, dancing, etc.

Requirement #3

1. Carpals
2. Cervical Vert.
3. Clavicle
4. Cranium
5. Femur
6. Fibula
7. Floating rib
8. Humerus
9. Lumbar Vert.
10. Mandible
11 Metacarpals
12. Metatarsals
13. Patella
14. Pelvis
15. Phalanges
16. Radius
17. Ribs
18. Scapula
19. Sternum
20. Tarsals
21. Tibia
22. Ulna
23. Ligaments



1 _____
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19 _____
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21 _____
22 _____
23 _____
24 _____

HUMAN SKELETAL SYSTEM

1. The cranial region is also called the _____

2,3. The skeleton provides attachment points for _____ amd protects vital _____ of the body.

4. The stomach is located in the _____ cavity.

5. The periosteum covers _____.

6. The shoulder and _____ have ball and socket joints.

7. The patella is also called the _____ cap.

8. The _____ is the center of a bone.

9. The _____ is the largest bone in the body.

10. The ear is composed of _____.

Match the list of words on the right with the definitions on the left. Write the answer in the answer column.

____11. Connects bones to muscles

____12. Joins bone to bone

____13. One of the jaw bones.

____14. A joint lubricant.

____15. Name of the elbow joint.

____16. The ankle bones.

____17. The shoulder blade.

____18. A partition between thoracic and abdominal cavity.

____19. Where red blood cells are formed.

____20. Another name for hip bones.

____21. Large bone in the lower leg.

a. Tarsals
b. Mandible
c. Marrow
d. Tibia
e. Haversian
f. Tendons
g. Scapula
h. Humerus
i. Sternum
j. Carpals
k. Ligaments
l. Immovable
m. Ossification
n. Joint
o. Pelvis
p. Diaphragm
q. Nasal
r. Hinge
s. Clavicle
t. Synovial

____22. The collar bone.

____23. Another name for the breast bone.

____24. Canals which nourish the bone.

____25. Results from adding calcium to bone tissue.

____26. Wrist bones.

____27. Large bone of the upper arm.

____28. A bone located in the nose.

____29. Joints of the skull.

____30. The point where two bones meet.

the HUMAN MUSCULAR SYSTEM

Abdominal retus

Achille's tendon

Biceps

Biceps of the femur

Deltoid

Gastrocnemius

Greater gluteal

Latissimus dorsi

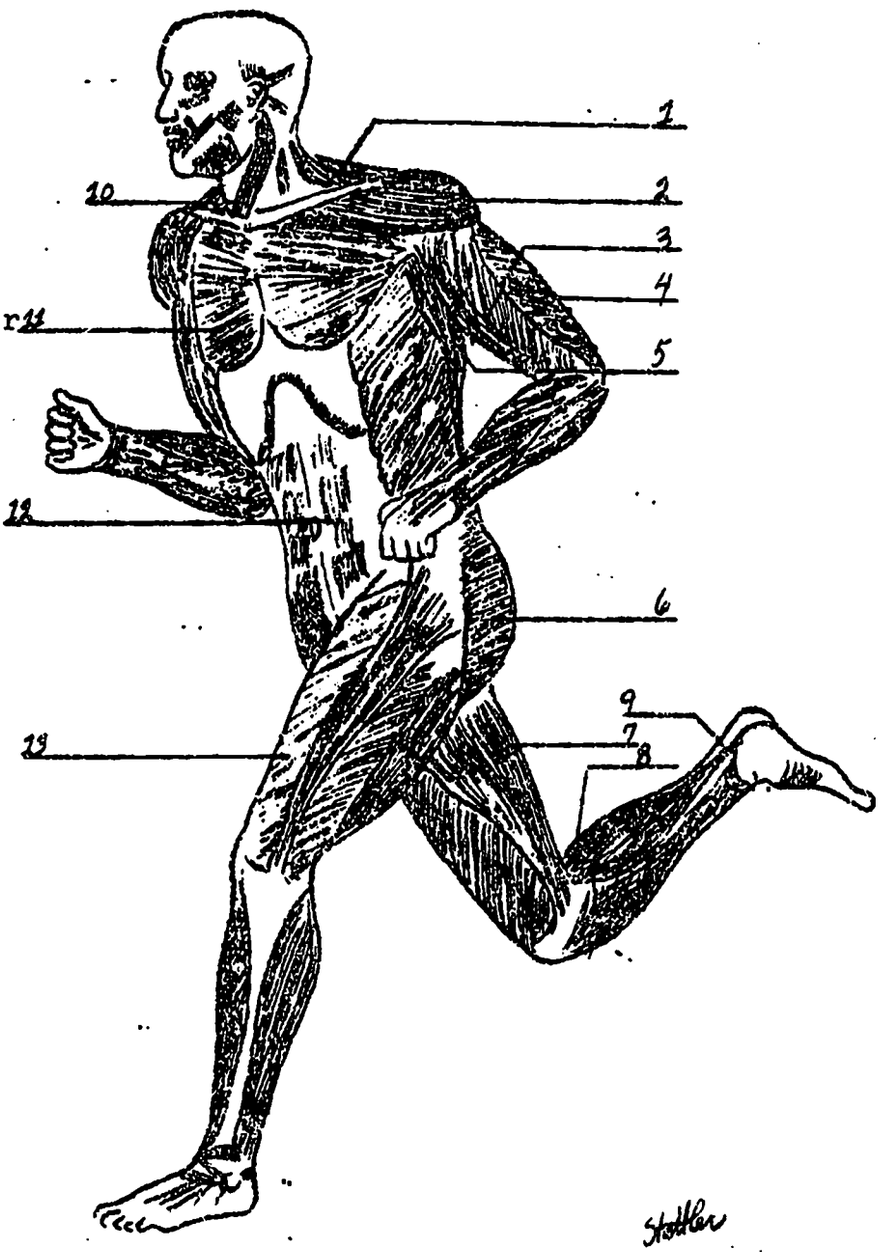
Pectoral

Quadricepts

Sterno-mastoid

Trapezius

Triceps



6. Self Test Over Muscles

Write your name and period number in the upper right corner of this page.

I. From Column A choose the word which is best described by the phrase in Column B. Write the letter of the word beside the number of the phrase on the provided answer sheet.

Column A	Column B
A. fatigue	1. Joins bone to bone at a joint. 1. _____
B. tendon	2. The muscle of a pair which bends a joint. 2. _____
C. ligament	3. The place where the muscle is attached to the bone it moves. 3. _____
D. striated	4. Sore muscles caused by the wastes of cells formed during exercise. 4. _____
E. contraction	5. Muscles with bands across them. 5. _____
F. none of the above	

Column A	Column B
A. sprain	6. A place where abdomen organs stick out through split sheets of muscle. 6. _____
B. strain	7. Muscles which can be consciously controlled. 7. _____
C. hernia	8. When a joint is pushed too far in a direction it is not used to going. 8. _____
D. dislocation	9. When a muscle is pulled too far. 9. _____
E. involuntary	
F. none of the above	

II. On the answer space, write TRUE beside the number of the sentences which are true. Write FALSE if the sentence is false.

10. Muscles must work in pairs. 10. _____
11. Muscles can pull but not push. 11. _____
12. Energy for muscle movement comes from food. 12. _____
13. Nerve impulses control muscles. 13. _____
14. Exercise increases the number of muscles in the body. 14. _____
15. Exercise decreases the blood circulation to muscles. 15. _____

III. Read the paragraph below before reading the statements below the paragraph. If the statement is TRUE, write true on the answer line. If the statement is FALSE, write false on the answer line.

A science student collected several pieces of muscle from a fish he had caught. Muscle A was observed under the microscope to have bands going across the cells. Each cell had many nuclei in it. Muscle B also had bands and had been taken from the heart. Muscle C had no bands.

16. Muscle A could have been taken from the stomach or intestine. 16. _____

17. Muscle C could work for several hours before resting. 17. _____

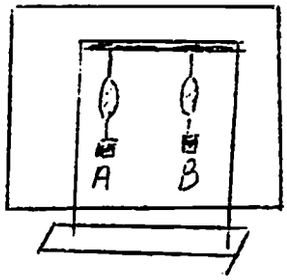
18. Muscle A could work very hard for a short time before becoming tired. 18. _____

19. Muscle C could have been taken from those attached to the skeleton. 19. _____

20. Muscles B and C are involuntary. 20. _____

IV. Read the paragraphs below before answering the questions below the experiment.

Harold removed both gastocnemiuses from a frog. He hung both from the same small glass rod. On the other end of each muscle he tied a 5 g. weight. A special marking pen was placed in a small hole in the weight. A paper was placed next to the pens. The apparatus looked like this:



Each muscle was touched by an electric impulse. Then each muscle was bathed with salt solution at 25° C. The muscles were touched by the impulse again. Last, muscle A was bathed in salt solution at 25° C. and muscle B was bathed in salt solution at 10° C. Again they were touched with the impulse. The length of the pen marks were measured after each time the muscles were stimulated. These were his results:

Treatment	Muscle A	Muscle B
1 None	10 mm.	11 mm.
2 Solution at 25° C	8 mm.	9 mm.
3 Solution on A-25° C. Solution on B-10° C.	7 mm.	4 mm.

21. Which of these are the variable of this experiment?

A. Size of muscle
B. Kind of muscle
C. Temperature of muscle
D. Weight on muscle
E. None of the above

21. _____

22. Which of these are conclusions proved by this experiment?

A. More weight keeps muscles from contracting as much.

B. Muscles decrease in their ability to contract the longer they exposed to the air.

C. Salt water improves the ability of muscles to contract.

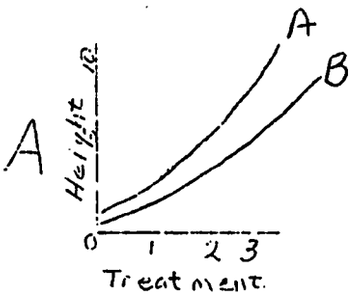
D. Cold decreases the ability of muscles to contract.

E. None of the above.

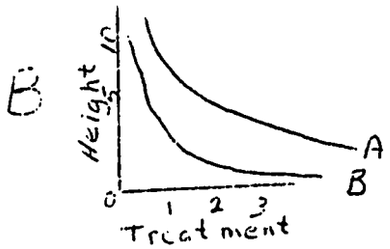
22. _____

23. Which graph best shows the results from the experiment?

A



B



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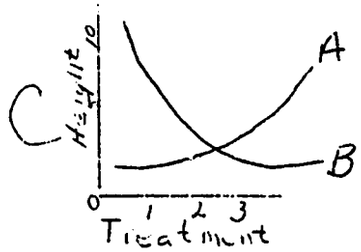
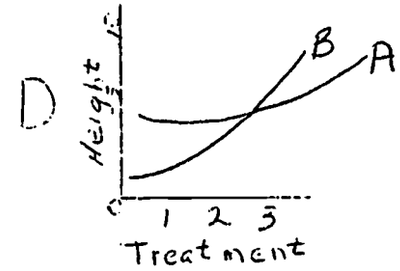
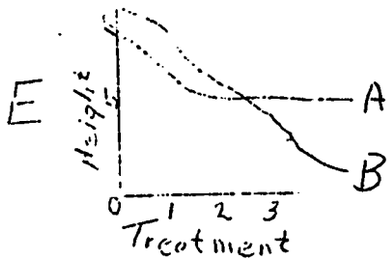


D



E



Have your answers checked. Correct all mistakes and take it to an instructor for final O.K.

FROG SKELETON LAB.

Supplemental Activity #1

For this activity you will need a frog, dissecting pan, scissors, and a probe. You will be working with a partner on this activity. You are interested in only one leg of the frog. Do not mess or cut up anything else.

1. Cut away the skin on one leg, both the upper and loser part of the leg.
2. Next cut away all of the muscle fiber so that the bone may be seen clearly.
3. Examine each of the following parts and make a rough sketch of all the following parts:
   - A. Hinge Joint
   - B. Ball and Socket Joint
   - C. Gliding Joint
   - D. Ligaments and Connective Tissue
   - E. Femur, Tibia and Fibula
   - F. Bone Marrow
     1) To examine bone marrow you will have to break a bone so that you can see the center.

SUPPLEMENTAL ACTIVITY #8

The Effect of Temperature on Muscular Contraction

Write your name three times before starting this experiment. Hold some ice cubes in the hand you used in writing your name for exactly one minute. At the end of one minute, write your name three times. Warm your hand by massaging it or placing it in hot water until it returns to a normal temperature and again write your name three times. Compare your results and explain in terms of the effect of temperature on muscular contraction.

SUPPLEMENTAL ACTIVITY #9

The Effect of Fatigue on a Muscle

Open and close your hand rapidly and forcefully, counting the number of times you can do this in twenty seconds. Repeat ten times and keep a record of the number of closures you make per trial. Make a graph of your results by plotting the number of closures per trial on the vertical scale against the number of trials on the horizontal scale. How is the effect of fatigue of the muscles shown by your results? Explain. Design and carry out an experiment of your own to demonstrate muscle fatigue. Do both experiments yield the same results? If so, is this characteristic of all muscles? Explain your answer.

THE HUMAN BODY--FOOD AND SUPPLIER TO THE CELL

NAME_____

TEST DAY_____

SECTION NO._____

TEXT:

The World of Living Things

Modern Health

REQUIREMENTS:

1. Read in WLT pages 285-299 (Food) Answer the questions on pages 293 and 294.
2. Read in WLT pages 304-318 (Digestion & Blood) Answer the questions on pages 309 and 313.
3. Keep a food chart (See page 4 in LAP)
4. Feel your pulse. (See page 5 in this LAP)
5. Activity Digestion in the Mouth. Write up results. (Page 5a in Lap).
6. Self Check Quiz--food. (See page 6 of this LAP)
7. Self Check Quiz - Digestion and Blood. (See page 6 of this LAP)
8. Current Science as assigned.

SUPPLEMENTAL ACTIVITIES:

1. Look over pages 318-413 in Modern Health. What are your five favorite pages? __ __ __ __ __
2. Draw a cross section of the human tooth. Name the different types of teeth, the total amount, and function of each type.
3. Food Lab. (See page 7 of this LAP)
4. Do vocabulary of science page 319 WLT.
5. Do vocabulary of science page 302 WLT.
6. Activity on page 287 in WLT.
7. Make a large diagram of the digestive system. On it, devise a way to trace clearly the digestion of food.
8. Make a report on the work of Dr. William Harvey and his pioneer investigation of blood circulation.
9. Any project listed on page 301 of WLT.
10. Heart Activity. (See page in LAP)
11. Review a Health Book.
12. Write a review of the Film, "How a Hamburger Turns Into You".
13. What does FS-92 say about your lunch.
14. Write a review of one of the other film strips in the Science R. C.

1. Given a calorie chart and several menus, the student will be able to figure the number of calories in a given meal and the average number of calories per day.

2. The student will be able to locate his own pulse and count the number of beats for a full minute.

3. Having completed the "Digestion in the Mouth" activity, the student will be able to demonstrate the presence of sugar in chewed crackers by using the sugar test.

4. The student will be able to demonstrate a knowledge of the "vocabulary of science" words by choosing the correct response to multiple choice questions with 80% accuracy.

5. Having completed the food test lab, the student will be able to demonstrate the presence of starch, sugar, fats, and protein by doing the proper test.

6. After completing the activity "Digestion in the Stomach", the student will be able to demonstrate what pepsin and hydrochloric acid does to protein.

7. Having completed the heart activity, the student will be able to identify the main parts of the heart.

8. Given a cross-section of the tooth, the student will be able to identify the main parts of the tooth.

For a C---Do all requirements

For a B---Do all requirements plus any 3 supplemental activities

For an A--Do all requirements plus 5 supplemental activities

TAPES:
WLT-14 pages 285-300 - FOOD
WLT-15 pages 304-310 - DIGESTION
WLT-15 pages 310-319 - BLOOD & CIRCULATION

CONCEPTS

1. Almost 90% of the protoplasm of each cell of the body is water.
2. The calorie is a measure of heat energy.
3. A food that contains carbohydrates, contains sugars or starches.
4. The nutrient used by the body mainly for growth and repair is protein.
5. Milk and milk products are a good source of phosphoris and calcium.
6. An element found in proteins but not in carbohydrates of fats is nitrogen.
7. The main use of water in the body is to carry cell waste and food
8. Vitamin D is important in preventing rickets.
9. Iodine is a test for starch.
10. Fat leaves an oily spot on brown unglazed paper.
11. Plasma is the liquid part of the blood.
12. The enzyme present in gastric juice is pepsin.
13. Germs in the body are destroyed by white blood cells.
14. Most of the digestion of food takes place in the small intestine.
15. The lining of the small intestine contains villi.
16. A red blood cell can pick up oxygen because the cell contains hemoglobin.
17. The outside layer of each tooth contains enamel.
18. Saliva changes starch to sugar in the mouth.
19. Blood vessels carrying blood away from the heart are arteries, while vessels carrying blood toward the heart are veins.
20. Digested food substances are transferred from the capillaries to the cells by lymph.
21. Milk and eggs are the best sources of protein.
22. A balanced diet consists of a food from the Basic Four Group.
23. Protein is used by the body for growth and repair.

FOOD CHART

Make a chart on notebook paper of everything you eat for three days and when you eat, drink, or chew it.

You also must keep track of how many calories are in each item. You also should determine the total calories for each meal and snack as well as average number of calories each meal, snack, and day. (i.e., breakfast, lunch, dinner, etc.) Then write a paragraph or more telling if your diet is balanced or not and why you come to your conclusion.

FEEL YOUR PULSE

Requirement #4

Feel your pulse. A good place to feel it is in the wrist where an artery is near the surface. See figure 15-9 on page 314 in The World of Living Things.

Press two fingers on the wrist near the base of the thumb and hold them against the bone. Actually, you will be pressing between two bones.

Count your pulse rate for one full minute. Work in pairs on this activity. Count each other's pulse five times. Figure out the average pulse rate. List all of the pulse rates on a chart on notebook paper.

The pulse rate shows the rate of your heart beat because the pulse beats every time your heart pumps. The pulse rate of most persons is somewhere between 70 and 90 beats per minute.

Now stand by a chair and run in place for one half minute. Count your pulse rate again. Do it three times. Figure out the average. List all of the pulse rates on a chart on notebook paper.

How do you explain the differences?

After you have been sitting quietly for a few minutes, take your pulse a third time. Record on your chart.

What do you think your normal pulse rate is?

How can you be sure?

Have your results checked.

DIGESTION IN THE MOUTH

Requirement #5

The purpose of this activity is to prove that starch digestion begins in the mouth. This can be done by first testing a corn starch solution and your saliva separately for simple sugar. The procedure for this test can be found on page 8 of this LAP. If there is sugar in either or both wash the test tube out and do it over. If your saliva still has sugar in it wash your mouth out with water.

Once you can demonstrate there is no sugar in either the cornstarch or the saliva you are ready to mix the two and test for simple sugar again. Mix the saliva and corn starch for at least two minutes before you add Benedict's solution or heat. Mark your results below. Save all three test tubes - have them with you when you come to get this activity checked.

Test	Color
Cornstarch	
Saliva	
Cornstarch and Saliva Mixed	

Can you be sure now that saliva and cornstarch react? _____

What is the enyzme in saliva that acts on the starch? _____

PART 2 CHAPTER 14 WLT

SELF CHECK QUIZ - FOOD

1. Night blindness is caused by a lack of vitamin _____.
2. A lack of vitamin "C" causes _____.
3. Vitamin _____ aids in blood clotting.
4-7. List the 6 nutrients.
8. What substance makes up about 65% of your body weight?
9. What substance is found in protein but not in sugars and starches
10. Rickets, weak soft bones, is caused by a lack of Vitamin _____.

PART 2 CHAPTER 15

SELF CHECK QUIZ - BLOOD AND CIRCULATION

1. How are red blood cells different in structure from other body cells?
2,3. Name two waste products the blood carries away from the cell.
4. What do white blood cells do?
5,6. Name two products the blood carries to the cell.
7. In what type of blood vessel does the red blood cell do it's work?
8. Name the vessels that lead away from the heart.
9. Name the vessel that leads toward the heart.
10. Which chamber of the human heart is the strongest?

FOOD LAB

Requirement #8

The purpose of this activity is to become aware of the nutrient content of some common foods. In the "Food Chart" you determine the energy content in calories. Now you find what foods have starches, sugar, fats, or proteins. You may work by yourself or in a group of two or three. Each group must test at least 10 foods for each of the four food types (starch-sugar-fat-protein) and record the results on page 9.

How to do each test is described on the next page. Remember - you are to run all four tests on each of 10 different food materials. PIT FALLS: Be certain your foods are pure and your test tubes CLEAN. Use soap and water. Some foods will be provided, but you may need to bring some from home.

When you or your group is finished have it checked. You may test as many things as you like. You also may want to run some sample tests to check out your technique. The instructor can help you with this if you like.

FOOD TESTS - HOW TO DO THEM

1. TEST FOR STARCH.....HOW TO DO IT.

Place the material to be tested on a paper towel. (If liquid, use a test tube.) Add two or three drops of iodine. A blue-black color indicates the presence of starch. If the iodine does not change color there is no starch.

2. TEST FOR SIMPLE SUGAR.....HOW TO DO IT.

Place the materials to be tested (a small piece about the size of a pea) in a test tube. Now add three or four drops of Benedict's Solution (blue). Place in boilding water for two to four minutes. A change in color indicates the presence of a simple sugar. Green means very little. Yellow means a fair amount, and brown to dark red means much sugar present. No change in color no simple sugar.

3. TEST FOR FAT.....HOW TO DO IT.

Rub the material being tested on a brown paper towel. If it leaves an oily mark, fat is present. (Caution - if the mark dries up, it was only water - not fat.) Let the mark stand for 10 minutes if you are not sure and check it again.

4. TEST FOR PROTEIN.....HOW TO DO IT.

Place a small piece of the material to be tested in a test tube and have the teacher add a few drops of nitric acid. (Caution - nitric acid will burn flesh, clothes, and books.) Now cook in the water bath for a minute or two. A yellow or brown color in the bottom of the tube indicates the presence of protein. Remove from heat as soon as it shows yellow, if there is much protein you may not need to heat at all.

.....A YELLOW-BROWN GAS MEANS IT IS TOO HOT.....

.....REMOVE FROM HEAT AT ONCE..DO NOT INHALE..POISON.....

.....TAKE TO TEACHER AT ONCE.....

If after cooking for a minute nothing happens, have the teacher add amonium hydroxide. A change in color to brown or yellow indicates protein. Wash out the test tube as soon as possible after you are done. (The acid in test tube can still burn you - use lots of water as you wash it out.)

RUN EACH OF THE FOUR TESTS ON EACH FOOD. POSITIVE + NEGATIVE -

DO AT LEAST TEN PER GROUP

Name of food	Starch Test	Sugar Test	Fat Test	Protein Test
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				

DIGESTION IN THE STOMACH

Supplemental Activity #3

Liquid food soon passes out of the stomach, but solid food must be acted upon by enzymes in the gastric juice in the stomach. Each enzyme does its own work, as the following investigation will show.

Place a piece of boiled egg white in each of four test tubes. Be sure the pieces are of equal size. Add an inch of water to all four test tubes. To one tube, add a pinch of PEPSIN and another inch of water. To another tube, add an inch of dilute hydrochloric acid solution. To the third tube, add a pinch of PEPSIN and an inch of the dilute hydrochloric acid solution. To the fourth tube just add an inch of water. Place all four tubes in a test tube rack.

Check your investigation daily for three days and keep a record on this page.

Write up the results of your investigation. Make conclusions concerning all three combinations in the test tubes.

Have your results checked by the teacher.

HEART ACTIVITY

Observe the beef heart prepared for demonstration by the instructor.

Obtain a pig heart from your instructor (suggest that you work in groups of four to six - supply of hearts is limited).

With the aid of the chart of the heart in your packet, determine where the blood enters the heart and where it leaves the heart. Now open the heart up and trace the flow of blood through it. Notice that a wall of muscles divides the heart in halves. There is no opening to allow blood to go directly from one side of the heart to the other. Each half is divided into two spaces with a valve between them.

Write a short description of what you saw. Be sure to use the following terms in your description:

arteries

veins

heart

aorta

right auricle

left auricle

right ventricle

left ventricle

valves

In your own words write a brief explanation of how the heart works. What makes it do its job?

Have all your work checked by your instructor.

R. L. Iverson
G. A. Cunningham
Marshalltown, Iowa

CONTINUITY OF LIFE

(Heredity and Genetics)

NAME _____

SEC. NO. _____

GRADE _____

Texts:

Modern Science I

The World of Living Things

LIFE: Its Forms and Changes

Modern Biology

Requirements:

- ☐ 1. In WLT study pages 338 to 356 and answer the "Check Your Understanding" questions on pages 345 and 346.
- ☐ 2. "Mendel's Word - Predictions" worksheet (See page 45)
- ☐ 3. "Laws of Segregation" Lab. (See page 5)
- ☐ 4. Predictions using 2 characteristics worksheet. (See page 6)
- ☐ 5. DNA! = Gene? Activity. (Page 7)
- ☐ 6. Write a short meaning to "Words to Remember" on page 335 of M.S.I.
- ☐ 7. Self Check Test. (See page 8-9)

Supplemental Activities:

- ☐ 1. "10 pennies a 1,000 times - More Probability" Lab. (See page 10-11)
- ☐ 2. Construct a 3-D model of a piece of DNA.
- ☐ 3. "An Apprentice Investigation of Genetic Ratios" on page 431 of LIFE. (Use your own paper to answer questions.)
- ☐ 4. "An Apprentice Investigation of Hereditary Traits" on page 437 of LIFE.
- ☐ 5. "An Apprentice Investigation into the Size of Genes" on page 443 of LIFE.
- ☐ 6. Predictions using 3 or more characteristics. (See page 12)
- ☐ 7. Select an independent project.

Grades:

C -- Requirements
B -- Requirements plus 2 supplemental activities.
A -- Requirements plus 5 supplemental activities.

1. The student will be able to explain the difference between an acquired and inherited characteristic. (In writing)

2. The student will be able to show that he knows the meaning of the words in the word list on 356 - 357 of WLT. (Multiple choice test - 80% accuracy.)

3. The student will be able to predict the physical characteristics of the offspring if he knows the gene type of the parents.

4. The student will be able to demonstrate the laws of segregation by flipping coins.

5. Given a set of puzzle pieces (12 pieces to a set - 3 of each) a student will be able to demonstrate 5 possible "genes" that can be made from the 12 pieces of "D.N.A."

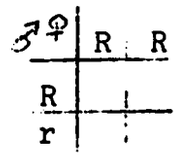
CONCEPTS

1. Dominant characteristics hide other characteristics.
2. A knowledge of science is an acquired characteristic.
3. Geneticists now think of genes as part of DNA molecules.
4. If two boxer dogs whose tails have been cut short have several puppies, the puppies will have normal length tails.
5. A characteristic you may inherit but that usually does not show up until later in life is baldness.
6. A person can inherit characteristics from either parent.
7. If a child inherits a gene for brown hair from one parent and a gene for blond hair from one parent, he will have brown hair.
8. Intelligence is defined by many scientists as the ability to learn.
9. If both parents have musical ability the child is likely to have musical ability.
10. Chromosomes do not carry determiners for personality.
11. Feelings toward other people is an acquired characteristic.
12. Brown eyes are dominant over blue eyes.
13. For a child to have blue eyes the genes for blue eyes must be present in both parents.
14. In the mother the cells that carry the genes are the egg cells.
15. In the father the cells that carry the genes are the sperm cells.
16. Some genes are neither dominant or recessive.
17. If there is one recessive gene around it may or may not show up.
18. If there is a dominant gene around it will always show up.
19. Acquired characteristics are not passed on in inheritance.
20. The ability to read is an acquired characteristic.
21. DNA carries all of your inheritance.
22. An acquired characteristic is one that you learn.
23. Environment makes a difference in every life.

MENDEL'S WORK-PREDICTIONS

Before doing this worksheet it will help if you read pages 314-230 in Modern Science I. and/or pages 426-430 in LIFE.

R = round pea seeds (dominant)
r = wrinkled pea seeds (recessive)



RR ♀ x Rr ♂

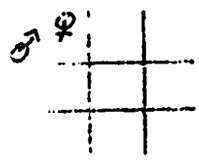
What percentage of the offspring will be:

_____ pure dominant _____ hybrid

_____ pure recessive

What percentage will have: _____ round seeds
_____ wrinkled seeds

G = green pod (dominant)
g = yellow pod (recessive)

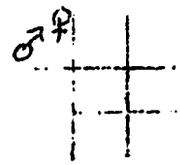


G_ ♀ X gg ♂
Can you guess the results before you work it out?

Write the percentage of: _____ pure dominant
_____ hybrid
_____ pure recessive

_____ green pods
_____ yellow pods

G = green pod (dominant)
g = yellow pod (recessive)

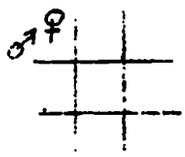


gg ♀ X gg ♂

Guess what the outcome will be.
Write the percentage of: _____ pure dominant
_____ hybrid
_____ pure recessive

_____ green pods
_____ yellow pods

R (red) color in cattle is completely dominant over r (white) color. The genes Rr make roan cattle.



RR ♀ X Rr ♂

What percentage will be:

_____ red _____ roan _____ white

LAWS OF SEGREGATION LAB

Prediction in genetics works on the laws of probability. Some basic information can be gained using coins as well as pea plants. Mendel used pea plants and it took many years for him to work out his data, you can come up with some very similar data in a few minutes.

A. Take a single coin and flip it many times. Keep track of how many times it comes up heads and how many times it comes up tails. Keep flipping the coin until you feel you have proof that you can make a percentage prediction of heads or tails when the coin is flipped.
(Keep track here)

H

T

B. For this part you will need 2 coins. Flip both coins until you feel you have proof that you can make a percentage prediction of any flip of both coins. (a minimum of 200 flips - no maximum - the more the better - if you can help - use it!_

2H

H - T

2 T

C. So far we have considered that each parent has two genes for each characteristic. In the case of a hybrid these two genes are different; however, in the case of a purebred both genes are the same. A given plant or animal may be purebred in a single set of characteristics and those characteristics may be either pure dominant or pure recessive To demonstrate this you could use a two headed coin. If you flipped a two-headed coin could you predict with any certainty? _____ of course you can - that's what we'd call a dumb question (provided it was thin enough so it would not rest on edge.) What if you used one two-headed coin and one two-tailed coin? _____

PREDICTIONS USING 2 CHARACTERISTICS

NAME _____

DIHYBRIDS AND TWO CHARACTERISTIC CROSSES

T = dominant tall plant
t = recessive short plant
W = dominant smooth pod
w = recessive wrinkled pod

TTWw x Ttww

There are four possibilities of gene combinations in the eggs and four in the sperm. Only one gene for tallness and one gene for roundness of pod can be found in each sex cell. The possibilities for eggs are shown below. Complete them for the sperms. Do the cross of characteristics to find the genes in each zygote.

♂ ♀	TW	Tw	TW	Tw

No. of each gene type

_____ TTWW
_____ TTWs
_____ TTww
_____ TtWW
_____ TtWw
_____ Ttww
_____ ttWW
_____ ttWw
_____ ttww

No. of each appearance

_____ tall, smooth pod
_____ Short, smooth pod
_____ Tall, wrinkled pod
_____ Short, wrinkled pod

HYBRID CROSSES

Have sheet one checked before you go on.

D = dominant dark hair
d = recessive light hair

DdBB x ddBb

B = dominant brown eyes
b = recessive blue eyes

♂ ♀					

Tell the number of offspring with each type of gene combination and the number with each kind of appearance.

DNA! = Gene?

To become more familiar with DNA and its parts, Adenine = "A", thymine = "T", cytosine = "C", guanine = "G", you should read and study pages 462 ("Cracking the Code") to page 272 of LIFE.

At first glance a puzzle with only four types a piece would be very simple. The trick is there are many of each piece.

For this activity you will need a set of puzzle pieces (12 pieces to a set - 3 of each). You are to make your own pieces and label them with "T" - "A" - "C" - or "G". In making the puzzle pieces remember "A" must fit "T". But must not fit either "C" or "G". "C" must fit with "G". When you have your pieces, your puzzle is how many different "genes" can be made with the 12 pieces of DNA? How many? _____ What are they? _____ Diagram them.

B. Explain why DNA can duplicate itself and make RNA. You can do this in writing or by demonstration or by making a model. Pages 466-468 in LIFE will help a great deal. The diagram of DNA→Protein is a beautiful and simple explanation to one of the most complicated activities a living thing goes through. Early in the course we described the cell is the basic building block (makes up living things) - well protein is the building block that makes up cells.

SELF CHECK TEST

1. The science of studying the way characteristics are passed from parent to offspring is called _____.
2. The small "beads" which are carriers of characteristics in cells are called _____.
3. What is deosyribonucleic acid and what does it do?
4. The process of ordinary cell division is called _____.
5. How does the nucleus of the resulting cell compare to the original cell in the process in No. 4?
6. The process of cell division which produces eggs and sperms is called _____.
7. How does the nucleus of the resulting cells in No. 6 compare to the original cell?
8. A human cell normally contains _____ pairs of chromosomes.
9. What is Gregor Mendel known for?
10. What is the difference between dominant and recessive characteristics?
11. What is the law of segregation?
12. What is a hybrid?
13. When the two genes present blend instead of one showing up over the other, it is called _____.

14. C = dominant, colored seed coats
c = recessive, white seed coats

Cross CC x Cc

Show all of your work.
Tell the number of pure dominants, hybrids, and pure recessive in the genes of the offspring. Also, tell the percentages of offspring with colored and white seed coats.

15. T = dominant tall
t = recessive short
B = dominant brown eyes
b = recessive blue eyes

Cross TtBb x TTBB

Show all of your work.
Tell the percentage of offspring with each gene type and also the percentage of offspring with each type of appearance.

10 PENNIES A 1000 TIMES

This activity is a further study into chance distribution or in mathematics. It is called probability. Today nearly all genetisis use computor time to assimulate genetic data. For a computor to work, some mortal must tell it "what" and "how" and some of the basic information to derive formulas was collected in this manner. Your problem is to flip 10 pennies all at once and count the number of heads (we will assume that the number of tails will be heads minus 10). Do this and record your information at least 1000 times. We suggest you use a glass to shake up the pennies and dump them out on a table to count. This is only a suggestion, if you want to use another method, that would be fine.

Finally, graph your information on page 11 and calculate a percent chance for each of the eleven possible combinations. You want to look to your math teacher for some help.

PREDICTIONS USING 3 OR MORE CHARACTERISTICS

T = tall plant, dominant
t = short plant, recessive
R = red flower color, incompletely dominant
r = white flower color
Rr = pink flower
Y = yellow seed, dominant
y = green seed, recessive

♂ TtRRYY X ♀ttRrYy

Tell the number of offspring of each gene combination type and the number of offspring of each appearance.

THREE CHARACTERISTICS

B = dominant brown eyes
b = recessive blue eyes
D = dominant dark hair
d = recessive light hair (blond)
T = tall, dominant
t = short, recessive

There will be eight possible combinations of genes in the eggs and eight in the sperms.

♂ BbDdTt X ♀BBDdtt

Tell the same information that was required above.

Do these on notebook paper.

INTRODUCTION TO EARTH SCIENCE

MATTER AND ENERGY

Learning Activities Package (LAP)

NAME _____

CLASS _____

TEST DATE _____

TEXTS:

Modern Science E.M.S.
Our Environment/How We Use and Control It

REQUIREMENTS:

- [ ] 1. Study pages 3-64 in Modern Science E.M.S., and complete pages 7-9 of this LAP.
- [ ] 2. Answer in complete sentences the Review Questions on pages 40 and 60 of Modern Science E.M.S.
- [ ] 3. Look at pages 117-139 of Our Environment/How We Use and Control It.
- [ ] 4. Write the meanings to vocabulary words listed in objective 9.
- [ ] 5. Do "Current Science" questions as assigned.
- [ ] 6. Density - Volume Lab. (See page 10 & 11)
- [ ] 7. Properties of Metals and Non-metals Lab. (See page 13-14).
- [ ] 8. Properties of Acids and Bases Lab. (See page 15-16).

SUPPLEMENTAL ACTIVITIES:

- [ ] 1. Heat caused Changes in Metallic Oxides Investigation on pages 17.
- [ ] 2. Complete pages 18-20 of this LAP. Simple Chemistry and Matter.
- [ ] 3. Change of State Lab. (See page 21).
- [ ] 4. Energy Exchange and Chemical Reaction Lab. (See page 22).
- [ ] 5. "Density of Liquids Investigation". See an instructor.
- [ ] 6. "Solubility of Chemical Salts Investigation". See an instructor.
- [ ] 7. Do a bulletin board. See an instructor.
- [ ] 8. Take care of the Science Room. See an instructor.
- [ ] 9. Independent projects. See an instructor.

GRADES:

For a C - do all requirements.

For a B - do all requirements plus 2 supplemental activities

For an A - do all requirements plus 4 supplemental activities.

FILM LIST MATTER AND ENERGY

6857	Molecular Motion
6853	Viberations in Molecules
6849	Acid Base Indicators
6167	Gravity and Weight
6728	Crystals
1674F	Atoms and Molecules
1675F	Molecules in Motion
1886F	Evidence of Molecules and Atoms
240F	Molecular Theory of Matter
1787F	Gravity and How it Affects Us.

FILM STRIPS:

FS 689	Matter
FS 690	Structure of Matter
FS 691	Molecular Motion
FS 617	Newtons Laws of Motion
FS 618	Gravitation
FS 622	Energy

TAPES:

A - ch 1 - 3 - 8

B - ch 1 - 8 - 17

C - ch 1 - 17 - 25

A - ch 2 - 29 - 41

B - ch 2 - 41 - 50

C - ch 2 - 50 - 56

D - ch 2 - 56 - 60

FILMLOOP

"How to Use a Balance Scale"

"How to Use an Overflow Can"

BEHAVIORAL OBJECTIVES

1. The student will be able to show that he understands the term volume by:

   a. Stating that volume is the space occupied.
   b. Finding the volume of a rectangular object by multiplying the length, width, and height.
   c. Finding the volume of an irregular object by the water displacement method.

2. The student will be able to demonstrate that the earth has gravity by weighing different objects on a spring scale; he will also be able to explain the difference between gravity and gravitation.

3. The student will be able to show that he knows the relationship of weight to density by:

   a. defining each term in writing.
   b. stating examples of each.
   c. finding the density of an object by the water displacement method.

4. The student will be able to name the three states of matter, define each and give examples of each in writing.

5. Given different shaped bottles and a balloon the student will be able to show:

   a. That liquids and gases take the shape of their containers.
   b. That liquids have a definite volume.
   c. That gases do not have a definite volume.
   d. That liquids and gases are both fluids.

6. Given a pyrex beaker, and bunson burner, a thermometer and some ice cubes a student will be able to demonstrate that:

   a. matter can be changed from one state to another by adding energy.
   b. he can find the melting point of ice.
   c. he can find the boiling point of water.

7. Given proper equipment, the student will be able to show that heat increases the volume of a substance; he will also be able to explain in writing why this is so.

8. Given a bell jar, a balloon and a vacuum pump, a student will be able to show that gases can change volume.

9. The student will be able to show that he knows the meaning of the following terms by his responses on a multiply choice test (90% accurate).

1. matter
2. mass
3. molecule
4. weight
5. element
6. compound
7. gravity
8. gravitation
9. chemical change
10. physical change
11. acid
12. base
13. force
14. plasma
15. solid
16. liquid
17. gas
18. fluid
19. solution
20. solvent
21. solute
22. sublimation
23. metal

10. Given a set of materials the student shall be able to determine if it is a metal or a non-metal using such characteristics as conductivity, luster, and density with 80% accuracy.

11. The student will be able to select those statements which are a part of the "Atomic theory of Matter" from a group of statements with 80% accuracy.

    a) All matter is made up of atoms.
    b) Atoms are the tiniest possible particles of an element.
    c) Atoms do not break up in chemical changes.
    d) Atoms of the same element are generally alike.
    e) Atoms of different elements are different.
    f) Atoms of an element have a definite average mass different from that of the atoms of other elements.

12. Given a set of materials, the student will be able to determine if they form a compound or mixture when combined with 80% accuracy.

13. Given a thermometer and a set of materials to be combined, the student will be able to determine which combination cause an energy giving chemical reaction, an energy taking chemical reaction, or no chemical reaction with 80% accuracy.

14. Given a set of solution and litmus paper, a student will be able to determine whether each solution acid, base, or neutral with 90% accuracy.

CONCEPTS

1. The pull that all matter exerts on other matter is known as gravitation.
2. A solid is a form of matter that has a definite volume and shape.
3. The temperature at which a solid changes to a liquid is called its melting point.
4. An object that floats beneath the surface of water without rising or sinking has the same density as the water.
5. Because they flow and have many similar characteristics, liquids and gases are known as fluids.
6. A solution that contains all the solute that it can hold at a given temperature is said to be saturated.
7. Crystals that resemble cubes and are made up of six equal faces are called hexagonal.
8. A gas is a form of matter that has neither a definite shape or volume.
9. A substance that goes into solution in another substance is known as a solute.
10. The temperature at which a liquid changes to a solid is called its freezing point.
11. The substance in which another substance dissolves is called a solvent.
12. The quantity of matter making up a substance is known as its mass.
13. The greater the mass of an object, the greater its weight.
14. A form of matter that has a definite volume but no definite shape is a liquid.
15. Mass per unit of volume is known as density.
16. The process by which water vapor changes to a liquid is known as condensation.
17. If a substance is heated, the speed at which its molecules move is increased.
18. The temperature at which a liquid changes rapidly to a gas is its boiling point.
19. The force with which the earth attracts any quantity of matter is measured as gravity.
20. The process in which a solid changes directly into a gas is known as sublimation.

21. The simplest form of matter that cannot be broken down by ordinary measures is the element.

22. An atom is the smallest particle of an element that still has all the elements properties.

23. A molecule is the smallest particle of a substance that can exist and still show the properties of the substance.

24. Elements that have luster and are good conductors are called metals

25. A compound consists of two or more elements combined chemically.

26. Litmus paper is used in the chemical test for acids and bases.

27. All matter has mass and volume.

28. In chemical reactions, matter cannot be created or destroyed.

29. Chemical formulas show the elements that make up a compound.

30. The atomic theory of matter.

    a. All matter is made up of atoms.

    b. Atoms are the tiniest possible particles of an element.

    c. Atoms do not break up in chemical changes.

    d. Atoms of the same element are generally alike.

    e. Atoms of different elements are different.

    f. Atoms of an element have a definite average mass different from that of the atoms of other elements.

Pages 7,8,9,17,18,19,20 are adapted from
Blanc and Fischler, Exercises and Investigation for Modern Science Earth, Matter and Space, 1967 Holt, Rinehart and Winston, Inc. pp. 1-4 and 11-18.

NAME _____

MATTER

Part one can be found in Modern Science EMS pages 3-8

1. What is matter? _____

2. What does the quantity of matter making up an object determine?

_____

3. List two properties of matter you can see and feel? (a) _____

_____ (b) _____

4. What property of matter is demonstrated when an object falls to the ground? _____

5. On what two things does the force we call weight depend? (a)

_____ (b) _____

6. Why does a larger ball of the same material weigh more than a smaller ball? _____

7. Why does a block of lead weigh more than a block of cork of the same size? _____

8. Which of the above two blocks will float? _____

DEFINE THESE TERMS

A. density _____

_____

B. Mass _____

_____

C. Matter _____

_____

D. Volume _____

_____

E. Weight _____

_____

Part 2 - pages 8-17 of M.S. - EMS

1. When is the plasma state of matter created? _____

_____

2. What are some special properties of (a) gas? _____

(b) a liquid? _____ (c) a solid? _____

3. How does cooling affect the state of most gases? _____

4. How does cooling affect the state of most liquids? _____

5. How does heating affect the state of most liquids? _____

6. How does heating affect the state of most solids? _____

7. How is the speed of the molecules in a substance when it is (a) cooled? _____

(b) heated? _____

8. How is the volume of most kinds of matter changed when they are

(a) cooled? _____

(b) heated? _____

9. Explain what is meant by the law of conservation of matter? _____

_____

_____

Define each term:

A. Atom _____

_____

B. Boiling point _____

_____

C. Condensation point _____

_____

D. Freezing point _____

_____

E. Melting point _____

_____

F. Molecule _____

_____

Part 3 - SOLUTIONS - pages 17-25 M.S. - EMS

1. Explain what happens when sugar dissolves in water. _____

_____

2. When you mix sugar and water, (a) which is the solute? _____

(b) which is the solvent? _____

3. Name the condition which exists in a solution when as many molecules come out of the solution as go in? _____

4. What will cause a supersaturated solution to return to its normal state? _____

5. List three uses of crystals. (a) _____

(b) _____ (c) _____

Tell what each term means.

A. Saturated solution _____

_____

B. Solution _____

_____

C. Supersaturated solution _____

_____

D. Suspension _____

_____

Density Lab

Part I

Objective: To find the density of a rectangular object by first finding its volume and then its mass by direct measurement.

Define: Volume _____

_____

Mass _____

_____

Density _____

_____

To find the volume of a rectangular block of wood, you need only two things, a block of wood with a number on it. (What is the number? _____ Use the same block for all of part I.), and a plastic ruler with a centimeter scale. Volume is equal to the width multiplied times the height and that multiplied times the length. (Vol. = W x H x L)

Now measure your block and make the measurements.

Width = _____cm. Height = _____cm. Length = _____cm.

The volume of your block is _____ cubic centimeters (cm^3)

Now you need to find the Mass of your block. To do this you need a balance scale and the block. Place the block on the scale. How many grams mass does it have? (See "How to Use a Balance Scale")
_____g.

Density as you know is the Mass/Volume ratio, or it can be written,

$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$ or Mass divided by Volume = Density (Vol. $\sqrt{\text{Mass}}^{\text{Density}}$)

Show your work:

Answer = _____g/cm^3

PART II - IRREGULAR OBJECT - A ROCK

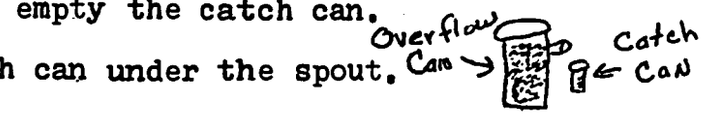
Objective: To find the density of an irregular object by first finding the mass and the volume by an indirect method.

To find the mass of your rock by using a balance scale. How many grams mass does your rock have? _____g

Find the volume of your rock in the following manner. (See Filmloop "How to Use an Overflow Can")

(1) Fill the overflow can with H_2O until it just runs out the spout into the catch can. Now empty the catch can.

(2) Now place the empty catch can under the spout.



(3) Gently lower the irregular object into the overflow can.

(4) Catch all of the H_2O that overflows into the catch can.

(5) Measure the volume of the H_2O caught in the catch can by:

(a) Pour the H_2O in a graduated cylinder and read the number of milliliters present.

(b) Using a balance scale, weigh the H_2O caught and convert into ml. (1 gram = 1 ml for water). Be certain you find the weight of just the H_2O.

If all else fails watch filmloop "How to Use an Overflow Can"

Answer:

Using the graduated cylinder I found the volume of the irregular object No. _____ to be _____ml.

Using the balance scale I found the volume of the irregular object to be _____ cc's.

Are both answers about the same? _____

A. If the mass stays the same and volume increases what will happen to the density? _____

B. Now calculate, using the data you have collected, the density of the rock. Show your work.

Answer _____g/cc

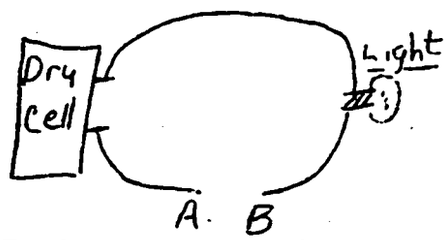
PROPERTIES OF METALS AND NON-METALS

Requirement #7

In this activity you will be finding some of the basic differences between metals and non-metals. The materials you will be testing are iron, copper, aluminum, lead, glass, a rock, plastic and wood. Test each (unless directed not to such as plastic and wood in heat you already know that wood burns and plastic melts and smells.) Material for it:

(a) Malability (ability to be bent and manipulated without breaking. Do not over do it and break the glass -- either you can bend it with your fingers or you can not if it snaps back this does not count. It must bend and stay bent.)

(b) Conductivity of electricity. Does an electric current flow through it? This can be done with a set up like this,



"Touch point "A" and "B"

To be sure the light and dry cell are working. Now, one at a time, place each thing to be tested so that "A" touches one end and "B" touches the other end. Does the bulb light up?

(c) Conductivity of heat. Place the substance to be tested on the edge of a hot, hot plate and put your finger on the substance, one inch from the edge of the hot plate. As soon as your finger gets too hot to hold -- remove it. Time how long it takes. Do not heat glass.

Fill in the time on your chart -- if it's after five minutes and your fingers are not hot - simple state the substance is a "poor conductor - 5 minutes".

(d) Luster. For this one record whether metalic or non-metalic. Luster is the kind of shine a substance has when light hits it.

(e) Test two additional materials of your choice.

RECORD ALL DATA ON THE CHART ON THE NEXT PAGE.

METALS AND NON-METALS CHART

Name of material	Malability	Conductivity of electricity	Conductivity of Heat in Time	Luster metalic or non-	Metal or non-metal
Aluminum					
iron					
copper					
lead					
wood					
plastic					
glass			DO NOT DO Glass will break		
rock					
Your choice					
Your choice					

PROPERTIES OF ACIDS AND BASES

Requirement #5

There are two groups of chemicals that are very common and yet very different. In fact, acids and bases are chemical opposites. The purpose of this activity is to explore some of the general properties of these two opposite types of chemicals. Be very certain that you use the proper chemical for each step.

Part I. What do acids and bases taste like?

Put a drop of acid on your finger from the bottle marked "TASTING ACID". This is a weak acid that will not burn your mouth or finger -- use only one drop. What does acid taste like? Is it sweet, sour bitter, or salty? _____ Now repeat with the bottle marked "TASTING BASE". Does a base taste sweet, sour, bitter, or salty? _____

Part II. Indicators:

Indicators are a group of chemicals which react differently to acids than they do to bases. Three types of common indicators are litmus paper, phenolphthaling and methyl orange. There are bottles marked "ACID" and "BASE" to be used in part II and III.

Part III

1. Put one drop of hydrochloric acid on a piece of blue litmus paper. What happens to the color of the paper? _____

2. Put a drop of hydrochloric acid on a piece of red litmus paper. What happens to the color of the paper? _____

3. Put one drop of sodium hydroxide base on a piece of red litmus paper. What color change takes place? _____

4. Put one drop of sodium hydroxide base on a piece of blue litmus paper. What color change occurs? _____

5. Put one drop of phenolphthaleim in clean test tube and add several drops of sodium hydroxide base. What color is the liquid now? _____

6. Put one drop of phenolphthaleim in a clean test tube and add a few drops of hydrochloric acid. What color is the liquid now? _____

7. Put one drop of methyl orange in a clean test tube and add a few drops of hydrochloric acid. What color is the liquid now? _____

8. Put one drop of methyl orange in a clean test tube and add several drops of sodium hydroxide base. What is the color change? from _____ to _____

Part III. Acids neutralize bases to form salts.

Put several drops of base in a clean test tube. Use one drop of phenolphthalein as an indicator and then add acid drop by drop. Shake after each drop is added. When the pink color of phenolphthalein just disappears, the solution should be neutral. To check your work add a drop of base and it should turn pink - add another drop and should be clear again. Take this to an instructor to be checked then put a drop on your finger and taste it. What does it taste like? _____

HEAT CAUSED CHANGES IN METALLIC OXIDES

Some chemical compounds may be broken down into the elements of which they are composed by heat. For example, when a small amount of mercury oxide (HgO) is heated in the flame of a Bunsen burner, oxygen is given off and drops of mercury collect on the walls of the test tube. Do you think all oxides of metals will produce both the metal and oxygen if they are heated?

DATA

Small amounts of different metallic oxides were heated in Pyrex test tubes. The table below shows what was found.

Metallic Oxide	Chemical Formula	Oxygen Released	Metal Formed?	Chemical Equation
Copper	CuO	yes	yes	$2\ CuO + heat \rightarrow 2\ Cu + O_2\uparrow$
Mercury	HgO	yes	yes	$2\ HgO + heat \rightarrow 2\ Hg + O_2\uparrow$
Lead	PbO_2	yes	no	$2PbO_2 + heat \rightarrow 2PbO + O_2\uparrow$
Manganese	MnO_2	yes	no	$3MnO_2 + heat \rightarrow Mn_3O_4 + O_2\uparrow$
Zinc	ZnO	no	no	(none)
Iron	Fe_2O_3	no	no	(none)

INTERPRETATION

According to the results shown in the table, which of the following conclusions are correct? Write <u>true</u> or <u>false</u> in the space provided.

1. Heating an oxide will always break it down into the metal and release oxygen. _____

2. Heating some oxides will release oxygen, but the metal may not always be produced. _____

3. Heating some oxides will break them down into a simpler oxide and release oxygen. _____

4. Heating some oxides causes them to combine with oxygen from the air. _____

5. The source of energy to cause the chemical reactions came from the flame of the Bunsen burner. _____

BE PREPARED TO EXPLAIN ANY OF YOUR ANSWERS WHEN YOU HAVE THIS CHECKED

LAB # 1 LAB #2 LAB #3 LAB # 4

	COLOR	STREAK	HARDNESS	CLEAVAGE	CRYSTALS	LUSTER	FRACTOR	ACID TEST	WHAT FORM IS IT	NAME
11										
12										
13										
14										
15										
16										
17										
18										
19										

SIMPLE CHEMISTRY AND MATTER

NAME _____

Part I pages 29-40 MS-EMS

1. If you mix sand and sawdust together, will you have a mixture or a compound? (a) _____ (b) Explain your answer.

_____

2. If you burn a piece of wood, are the products formed a mixture or a compound? (a) _____ (b) Explain your answer.

_____

3. When tea is placed in a cup of hot water, do you have a mixture or a compound? (a) _____ (b) Explain ____

_____

_____

4. Give three examples of elements used in making articles in common use. (a) _____ (b) _____ (c) _____

5. What are the two main groups of elements? (a) _____

(b) _____

6. List five properties by which one element can be distinguished from another. (a) _____ (b) _____

(c) _____ (d) _____ (e) _____

7. List the three main kinds of particles making up an atom. (a) __

_____ (b) _____ (c) _____

8. Diagram a helium atom and label the three main kinds of particles.

9. What part of an atom takes up the most space? _____

10. What is the smallest particle of a compound called? _____

_____

11. In one word, what is needed in order to break down a compound into the atoms of which it is formed? _____

ROCK AND MINERAL IDENTIFICATION

LAB #1

COLOR AND STREAK

You may work in groups of two or three. Each of you must keep a set of records for your own LAP. Send one member of your group to pick up a test mineral set which contains numbered samples. The names of these minerals are not important at this time. You will simply refer to them as specimen 1, 2, 3, and so on. Later the names will be important. In this lab we are interested only in the color of the sample and color of streak it leaves on unglazed porcelain.

COLOR

The color of a rock or mineral is the most obvious physical characteristic and judged most accurately on a fresh surface. However, the minerals used in this lab are not to be smashed. They are fresh samples already; when working in the field you will always want to use a fresh surface. Record the color of each sample as best you can. You will soon learn that even though the color is easy to see, it is not a very important characteristic in many identifications.

STREAK

Using the same set of samples and a streak plate (a small square of unglazed porcelain) firmly rub each sample over the plate. Record on your chart the color of the streak. If there was no streak simply record "NONE". If the streak plate is a big mess, use some cleanser and wash it off. When you put it back be <u>sure</u> it is clean.

Define:

A. Atom _____

_____

B. Metal _____

_____

C. Mixture _____

_____

D. Nonmetal _____

_____

E. Electron _____

_____

F. Proton _____

_____

G. Neutrons _____

_____

H. Nucleus _____

_____

I. Energy levels _____

_____

ROCK AND MINERAL IDENTIFICATION

LAB #2
HARDNESS

Materials needed:
1. Set of samples (same as lab #1)
2. Finger nail (your own on your finger)
3. Glass

When testing rocks for hardness, there is one common mistake made, that is powder mark is mistaken for a scratch. The way you can tell the difference is powder will rub away - a scratch will not. Another possible error is when the cement that holds the crystals of a rock together is weak the rock crumbles.
Be sure you test the crystals and not the cement.

PART I

First: Divide your rock set into three groups. In the first group place all those that you can scratch with your finger nail. Be sure the rock is not grinding off your finger nail if a mark is left. Next, from the remaining samples find all of those that will scratch glass and put them in a pile. The remaining samples are those that are too hard to be scratched by your finger nail and too soft to scratch glass. Hardness can be expressed by a number from 1 to 3 (see page 8). Now go to page 4 and 5 and record the hardness (1, 2, or 3) for each sample. (DO THIS IN PENCIL YOU MAY WANT TO CHANGE IT!!!)

PART II

Starting with the rocks in your group #1, line them up from softest to hardest. Next do group #2 and then #3, so you have all specimens lined up from softest to hardest. You can do this by scratching the samples against each other. If one will scratch another-then it is harder. The one that will not scratch another is the softest. Under Column A, list the numbers of the samples in the order you have layed them out, starting with the softest one, then have it checked.

Next record the number hardness of each sample from 1 to 3 in Column B starting with the softest and working to the hardest. Then take it to an instructor to be checked.

A	B

Part 2 - CHEMICAL REACTIONS - pages 41-50 MS-EMS

1. Which particles in an atom determine the chemical behavior of the atom? _____

2. When atoms combine chemically, what three things may happen to these particles? (a) _____ (b) _____ _____ (c) _____

3. What does the atomic number tell us about an element? _____ _____

4. The atomic weight of an element. The number of _____ plus the number of _____.

5. Why are the atomic weights of most elements not exact whole numbers? _____ _____ _____

6. Why do scientists use symbols for the names of chemical elements? _____ _____

7. List two things we can learn from the formula of a compound? (a) _____ (b) _____

Part 3 - page 50-56 MS-EMS

Answer the 5 Review questions on page 56.

IVERSON'S SCALE OF HARDNESS

1. Specimen can be scratched with a finger nail.

2. Speciman can not be scratched with a finger nail AND will not scratch glass.

3. Specimen will scratch glass.

Now on the main chart, under hardness, record the hardness of each rock.

There is a more accurate scale of hardness called "Mohs Scale" which may be needed if you use some other books for identification.

"MOHS SCALE"

1.	Talc	1. Finger nail scratches it easily.
2.	Gypsum	2. Finger nail barely scratches it.
3.	Calcite	3. Copper penny just scratches it easily.
4.	Fluorite	4. Steel knife scratches it easily.
5.	Apatite	5. Steel knife scratches it.
6.	Feldspar	6. Steel knife does not scratch it, scratches window glass easily.
7.	Quartz	7. Hardest common mineral; scratches steel & hard glass easily.
8.	Topas	8. Harder than any common mineral - a semi-precious stone.
9.	Corundum	9. It scratches topaz.
10.	Diamond	10. Hardest of all minerals.

CHANGE OF STATE ACTIVITY

Supplemental Activity #4

Matter exists in three states. These are solid, liquid, and gas. This lab is to demonstrate these three states of matter.

MATERIALS:

(1) ice cubes
(2) pyrex beaker

(3) Centigrade thermometer
(4) Hot plate

PROCEDURE:

A. Place ice (solid) in beaker and find its temperature as it melts. The temperature at which ice melts is _____c. What does ice change to as it melts? _____ Does this represent a change of state? _____ What state does the ice change to as it melts? _____

B. Continue heating the ice until it all melts. Does the temperature change as melting is taking place? _____ How long does it take for all of the ice to melt? _____ What happens to the temperature of the water after the ice is melted? _____

C. Continue heating the water until it begins to boil. At what temperature does boiling occur? _____ What is happening to the water as it boils? _____ Does this boiling represent a change in the state? _____ What is the water (liquid) changed to? _____ or _____ How can you prove that steam is being formed? _____

_____

_____

Can you see the steam? _____
What is it called when a solid changed directly to a gas without going through the liquid state? _____
Give an example _____ to _____

Name the three states of matter and give an example of each.

	State	Example
1.	_____	_____
2.	_____	_____
3.	_____	_____

LAB #3

SURFACE CONDITION

For this laboratory you will use the same sample set that you used for testing color, streak, and hardness, and will record your information on the main chart. You may continue to work the way you are or work with someone new.

SURFACE CONDITION

The surface condition of a sample can be described in one or several ways. We will use four terms: 1. Cleavage 2. Crystals 3. Luster and 4. Fracture

CLEAVAGE

We say a mineral has cleavage when it tends to split easily, leaving a smooth flat shiny surface. Some minerals will not do this at all, others will split in one direction, others in two directions and a few have cleavage which means that they will split smoothly in any of the three plains. A cleavage surface can be identified by looking for parallel surfaces that are smooth and "twinkle" in direct light.

In the column marked cleavage, record the number of cleavage surfaces. This will be either none, 1, 2, or 3. Have your work checked! If you are a little confused listen to the tape labeled "Cleavage".

CRYSTALS

The crystal is a pure package of a mineral formed in a specific shape. Crystals which form very slowly can get quite large in size, but crystals which form fast are often very small. The particular shape of any crystal is due to the way in which the molecules line up. The basic crystal shape can be found on page 21 of M.S.E.M.S. figure 1-11. For the purpose of identification, a rock is said to have a crystal structure when it is composed of many smaller crystals

ENERGY EXCHANGE AND CHEMICAL REACTIONS

Supplemental Activity #5

When ever there is a chemical reaction heat is either given off or taken in. If there is no energy exchanged, there is no chemical reaction. The form of energy most often exchanged is heat and sometimes light and motion, the chemical reaction in a dry cell gives up energy in the form of electricity. A chemical reaction is also often accompanied with fizzing or bubbling if a gas is produced.

There are four substances to use in this activity, there are two liquids, and two solids. The names are not important to you for this activity, so we just use numbers 1-2-3-4.

Using a test tube, mix small quantities of each material with every other material. Hold the bottom of the test tube in your hand so that you can feel any change in temperature, even a very small one. Complete the table below. Be prepared to prove your statements if the instructor asks you to.

Combination	Get warmer Get colder Stay the same	Chemical Reaction or No Chemical Reaction
#1 + #2		
#1 + #3		
#1 + #4		
#2 + #3		
#2 + #4		
#3 + #4		

Questions:

stuck together. This characteristic will be most useful in identifying rocks made up of several minerals. Now take your set of samples and tell if each is made of one big crystal, small crystals all of the same kind, small crystals of different kinds (in this case tell how many different kinds are present) or if it is non-crystal. In this lab you will find a hand lens or a sterioscope will be a necessity.

In the column marked crystals record the number of different kinds of crystals and the approximate size. Have your work checked!

LUSTER:

Luster is the kind of "shine" that a sample has. Luster can be described in such terms as dull, glossy, metalic, waxy, greasy, glassy, shiny, flinty, or pearly. Now go through each of the samples and describe their luster using the terms given. Record your information on the chart. If you can think of terms better than these use them! Have your work checked!

FRACTURE:

Fracture is when a rock or mineral breaks along a surface that is not smooth and flat. Some terms used to describe some fractures are: uneven, sugary, splintery, earthy, and curved or shell-like. Use one of these terms to describe each sample in your set. Some samples will have NO fracture. Record this information on your chart under the column marked fracture.

Name ..... Class ..... Date .....

Densities of Liquids

INVESTIGATION 1-A

PROBLEM

Each form of matter has a certain mass or weight. The density of a solid can be determined by comparing the weight of one cubic centimeter (cm^3) of the substance to the weight of one cm^3 of water. How can the density of a liquid be determined?

INVESTIGATION

The weight in grams of 100 milliliters of each liquid tested was found, as shown in Fig. 1-3. The results of the experiment are shown in the table below.

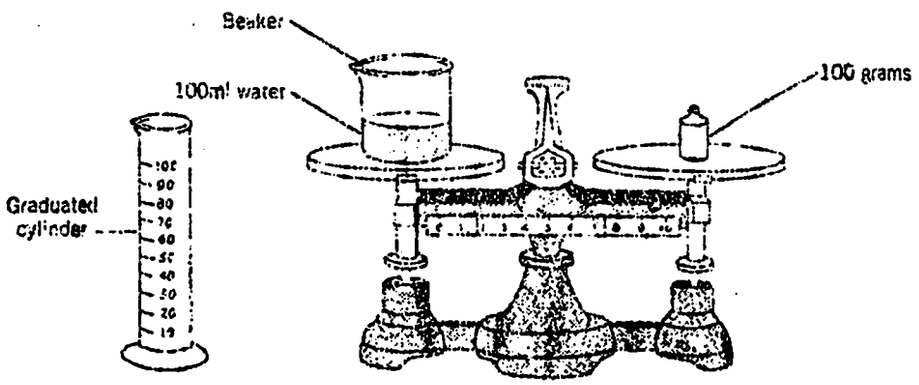


Fig. 1-3

Liquid Tested	Volume in Milliliters	Weight in Grams	Density Per Cm^3
Water	100	100	1.00
Cooking Oil	100	92	0.92
Rubbing Alcohol	100	80	0.80
Glycerin	100	125	1.25
Whole milk	100	103	1.03

INTERPRETATION

According to the results shown in the table, mark each of the following statements true, false, or not proved in the space provided.

1. The volume of one milliliter of any liquid equals one cubic centimeter. .....
2. The weight of one milliliter of glycerin equals one gram. .....

ROCK AND MINERAL IDENTIFICATION

LAB #4 D

ACID TEST

Rocks and minerals made up of calcium compounds will fizz when a drop of weak hydrocloric acid (HCI) is dropped on it. The most common rocks which fizz are limestone and marble. If the rock does not fizz right away try scratching it and adding another drop to the powder and watch for small bubbles to appear. This is also a positive reaction.

Add a drop of diluted HC_1 to each sample and mark your chart as to whether or not each sample reacted to the acid. Tell how much they fizz, this may be helpful. Have an instructor check your chart.

3. Alcohol and water can be mixed without separating. _____

4. If cooking oil and water are mixed, the oil will float on top of the water. _____

5. If glycerin and alcohol are mixed, the alcohol will float on top of the glycerin. _____

6. Whole milk has a greater density than skim milk. _____

7. The weight of one milliliter of water equals one gram. _____

8. The temperature of a liquid has an effect of its density. _____

9. If a liquid has a density greater than 1, it will float on water. _____

10. The same volume of liquid must be weighed each time in order to find its density. _____

APPLICATION

Explain why milk is homogenized to prevent the cream from separating out and floating on top of the milk.

Blanc, and Fischler, Exercises and Investigations for Modern Science - Earth, Matter and Space, 1967. Holt Rinehart and Winston, Inc. pages 5,6.

LAB E

FORM and NAME

Now complete the last two columns on your chart. Under the column labeled "What Form Is It" record if the sample is a mineral or a rock, if it is a rock, is it igneous, sedimentary or metamorphic. Under the column labeled "name" record the name of the rock. You may want to use a rock book, rock key, or a labeled rock collection to help you identify the rocks. Have your work checked!

There are filmstrips on "Minerals", Igneous Rocks", "Sedimentary Rocks", and 'Metamorphic Rocks" which will help you on form. You may wish te find names before form - this would be O.K.

ROCKS AND MINERALS IN OUR KITS

Basalt
Mica
Limestone
Chert
Feldspar
Obsidion
Gneiss
Sandstone
Agate
Limonite (iron ore)
Chalcedony
Marble
Shale (slate)
Galena
Quartzite
Schist
Granite
Calcite
Quartz
Gypsum

What form is it?

1. Mineral
2. Igneous
3. Sedimentary
4. Metamorphic

NAME _____

SOLUBILITY OF CHEMICAL SALTS

PROBLEM

Scientists are familiar with hundreds of different kinds of chemical salts which differ in their properties by having different colors, tastes, and crystal shapes. Do chemical salts also differ in their ability to dissolve in water?

MATERIALS

Test tubes, test tube rack, graduated cylinder, laboratory balance, stirring rod, flashlight, powdered samples of different salts, such as sodium chloride, iron nitrate, copper sulfate, etc.

PROCEDURE

Place several test tubes in a test tube rack and pour an equal amount of water into each test tube. Weigh out exactly 25 grams of each salt being tested. Add the salt, a few grains at a time, to the water in a test tube until no more salt will dissolve when the water is stirred. Carefully weigh the amount of salt left over to determine how much salt dissolved in the water.

OBSERVATIONS

Record your results in the following table (indicate the degree of solubility of each salt by writing good, medium, or poor).

Name of Salt	Milliliters of Water	Grams of Salt Dissolved	Degree of Solubility
Sodium chloride			
Iron nitrate			
Copper sulfate			

1. Why would shining a beam of light through a solution help you determine whether the salt is completely dissolved? _____

_____

_____

2. What effect does stirring the solution have on the rate at which the salt dissolves? _____

3. What effect would heating the water have on the rate at which the salt dissolves? _____

ROCK AND MINERAL IDENTIFICATION

Supplementary Activity #2

SPECIFIC GRAVITY

Specific gravity is another property that is helpful in identifying a mineral. It is the ratio of the weight of a mineral to the weight of an equal volume of water. (The specific gravity of a mineral tells you how many times as heavy as water it is.) Nearly all minerals are heavier than water so their specific gravity numbers are usually greater than one. To find the specific gravity of a mineral:

1. Weigh the mineral on a scale to find its weight.
2. Weigh the mineral while it is completely submerged in water. (According to Archimedes Principle its weight loss is equal to the weight of the water displaced.)
3. Thus we have:

$$\text{Specific gravity} = \frac{\text{weight of sample}}{\text{loss of weight in water}}$$

Example:

Weight of specimen = 5 g in air, 3 g in water

Then specific gravity of specimen = $\frac{5g}{2g} = 2.5$ - This means that the specimen is 2.5 times as heavy as water.

Now: Proceed to find the specific gravity of at least six specimens and record all of the information you collect on a separate sheet of paper in an orderly form. Have your work checked.

INTERPRETATION

Fill in the blank words in the following paragraph in the numbered spaces at the right.

Many salts are formed by the process of (1) when an (2) is added to a (3). The process of neutralization is complete when blue litmus paper will not turn (4) in the solution and red litmus paper will not turn (5). The salt formed if hydrochloric acid is used in the reaction is called a (6). Similarly, if nitric acid is used, the salt formed is called a (7), and if sulfuric acid is used, the salt formed is a (8). Thus, we see that salts differ in their properties, but they all contain one element or radical from an (9) and one element or radical from a (10).

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

APPLICATION

It is also possible to dissolve liquids in water. For example, if you carefully measure out 50 milliliters of water and 50 milliliters of alcohol and pour the alcohol in the water, you would find that the volume of the mixture is less than 100 milliliters. Explain how this is possible.

Blanc, and Fischler, Exercises and Investigations for Modern Science - Earth, Matter and Space, 1967
Holt Rinehart and Winston, Inc.
pages 19, 20.

KEY TO THE COMMON ROCKS AND MINERALS OF IOWA

Prepared by Ross L. Iverson

For Iowa Teachers Conservation Camp, University of Northern Iowa

NOTE: All tests should be made on a freshly broken surface.

1a. Specimen will not scratch glass . . . . . 2a or 2b

2a. Specimen effervesces when a drop of acid is placed on it . . . 3a or 3b

3a. Specimen shows cleavage in three planes . . . . . CALCITE

3b. Not as 3a . . . . . 4a or 4b

4a. Specimen black . . . . . CARBONACEOUS LIMESTONE

4b. Specimen not black . . . . . 5a or 5b

5a. Specimen thin layered splitting along layers . . . . . CALCAREOUS SHALE

5b. Specimen not thin layered . . . . . 6a or 6b

6a. Specimen composed entirely of shells . . . . . SHELL LIMESTONE

6b. Specimen not composed entirely of shells . .7a or 7b

7a. Specimen scratches a knife . . SANDY LIMESTONE

7b. Specimen will not scratch a knife . .8a or 8b

8a. Specimen showing no definite particle, very smooth to touch but not glossy . . . . . LITHOGRAPHIC LIMESTONE

8b. Specimen composed of small particles . . . . . GRANULAR LIMESTONE

2b. Specimen does not effervesce . . . . . 9a or 9b

9a. Specimen effervesces with acid only when a powder is formed by scratching with a knife point and placing acid on the powder; often buff colored, often found containing dendrites (see page 52 and 53 in Zim) . . . . . DOLOMITIC LIMESTONE

9b. Not as in 9a . . . . . 10a or 10b

10a. Specimen can be scratched with a fingernail (i.e. specimen will not scratch your fingernail) . . . . . 11a or 11b

11a. Specimen glassy and translucent . . . . . 12a or 12b

12a. Specimen found in long crystals . . . SELENITE

12b. Specimen found in thin sheets. . . . 13a or 13b

13a. Sheets black . . . . . BIOTITE MICA

13b. Sheets white . . . . . MUSCOVITE MICA

R. L. Iverson
G. A. Cunningham

Marshalltown, Iowa

NAME _____

CLASS _____

ROCK SET NO. _____

TEST DAY _____

ROCKS AND MINERALS OF THE EARTH'S CRUST

TEXTS: Modern Science - Earth, Matter and Space
Our Environment: Its Relation to Us
Earth Science: The World We Live In

◯ 1. Study pages 273-294 in Modern Science E.M.S. and answer the Review Questions on pages 279,286, and 291.

◯ 2. Look over pages 21-71 in Earth Science: The World We Live In.

◯ 3. Answer the "Questions for Thought" part A with a letter on page 293 of Modern Science E.M.S.

◯ 4. "Current Science" Questions as assigned.

◯ 5. Rock and Mineral Identification Lab.

- ☐ A. Color and Streak. (Page 6)
- ☐ B. Hardness. (Page 7 & 8)
- ☐ C. Surface Condition. (Page 9 & 10)
- ☐ D. Acid Test for Calcium Carbonate. (Page 11)
- ☐ E. Form and Name. (Page 12)

SUPPLEMENTAL ACTIVITIES:

◯ 1. Study pages 259-278 in Our Environment: Its Relation to Us and answer the "Check-up" Questions on pages 261 and 278.

◯ 2. Specific Gravity Lab. (Page 13)

◯ 3. Make Rock Collection. (Page 14)

◯ 4. Write a short report about a newspaper or magazine article concerning geology.

◯ 5. Care of Science Room. (See an instructor)

◯ 6. Bulletin Board. (See an instructor)

◯ 7. Independent Project. (See an instructor)

◯ 8. Take notes over 3 filmstrips not used in class by an instructor.

GRADES:
For a C - Do the requirements only.
For a B - Do the requirements and any two supplemental activities.
For an A - Do the requirements and all three supplemental activities.

11b. Not as in 11a . . . . . 14a or 14b

14a. Specimen has an astringent taste . . . . . ALUM

14b. Not as in 14a . . . . . 15a or 15b

15a. Specimen whitish with sparkly granules . . . . . ROCK GYPSUM

15b. Not as in 15a . . . . . 16a or 16b

16a. Specimen does not break along definite planes . . . . . 17a or 17b

17a. Has brown to yellow streak . . . . . LIMONITE

17b. Does not have brown to yellow streak . . . . . KAOLIN

16b. Specimen breaking along definite planes . . . . . 18a or 18b

18a. Specimen black . . . CARBONACEOUS SHALE

18b. Specimen not black . . . ARGILLACEOUS SHALE

10b. Specimen cannot be scratched by fingernail . . . . 19a or 19b

19a. Specimen not arranged in layers . . . . . 20a or 20b

20a. Metallic luster . . . . . 21a or 21b

21a. Specimen has cubic cleavage . . . . GALENA

21b. Not as 21a with a red streak . . HEMATITE

20b. Non-metallic in luster and rusty yellow to orange in color, sometimes dark brown; streak brown to yellow . . . . . LIMONITE

19b. Specimen arranged in layers, often breaking along these layers . . . . . 22a or 22b

22a. Specimen black . . . . . 23a or 23b

23a. Dull luster, claylike . CARBONACEOUS SHALE

23b. Silky luster with flecks of mica in fresh breaks . . . . . SLATE

22b. Specimen not black; made of claylike particles . . . . . SHALE

1b. Specimen will scratch glass . . . . . 24a or 24b

STUDENT OBJECTIVES

1. Student will be able to determine the hardness of a rock to within 1 point by using plate glass, iron, fingernail and copper penny.
2. Student will be able to determine if a rock contains calcium carbonate by using a weak solution or acid.
3. Student will be able to recognize 12 or 14 samples of common rocks and minerals on sight.
4. A student will be able to recognize luster, cleavage, or fracture with the same profficiency that he can recognize the rock.
5. A student will be able to tell 80% accuracy if a rock is sedimentary, igneous of metamorphic.

FILMSTRIPS:

FS-1 The Minerals

FS-2 Idendification of Minerals

FS-3 The Rocks

FS-4 Igneous Rocks

FS-5 Sedimentary Rocks

FS-6 Metamorphic Rocks

A 431-7 The Earth's Crust

TAPES:

What is the Earth's Composition? Chapter 10, pp. 275-279

What Makes Up the Crust of the Earth? pp. 271-286

How Can Minerals Be Identified? pp. 286-291

* How to use the "Key to the Common Rocks and Minerals of Iowa"

* Cleavage

Film Loops:

Rock and Mineral Tests

24a. No particles seen even with a microscope--specimen is a mineral . . . . . 25a or 25b

25a. Cleavage observable and non-metallic . . . . . 26a or 26b

26a. Mineral dark and needle-like . . . . . HORNBLENDE

26b. Mineral not dark and needle-like . . . . . 27a or 27b

27a. Luster is a dull glassy nature; color pink, gray, white or blue . . . . . ORTHOCLASE FELDSPAR

27b. Same as above, color usually dark green or blue . . . . . PLAGIOCLASE FELDSPAR

25b. No cleavage or specimen is metallic . . . . . 28a or 28b

28a. Luster metallic . . . . . 29a or 29b

29a. Brassy luster . . . . . PYRITE

29b. Luster not brassy . . . . . MAGNETITE

28b. Non-metallic luster . . . . . 30a or 30b

30a. Yellow brown streak . . . . . LIMONITE

30b. Not as 30a . . . . . 31a or 31b

31a. Luster glassy and texture greasy to touch, conchoidal fracture, color milky, rosy or smoky . . . . . QUARTZ

31b. Luster waxy, not greasy to touch . . 32a or 32b

32a. Specimen is translucent (some light will pass through) . . . . . 33a or 33b

33a. Banding is very obvious . . . AGATE

33b. Not as 33a . . . . . CHALCEDONY

32b. Not as in 32a . . . . . 34a or 34b

34a. Specimen is rich deep red . . . JASPER

34b. Not as in 34a . . . . . 35a or 35b

35a. Light in color . . . . . CHERT

35b. Black; hardness-8 . . . . SPINEL

24b. Specimen is composed of particles (i.e. granular) . . . . . 36a or 36b

36a. Specimen is composed of particles that can be seen individually without aid of a magnifying glass . . . 37a or 37b

37a. Minerals in specimen angular and interlocking .. 38a or 38b

CONCEPTS
(Rocks & Minerals)

1. The solid part of the earth is known as the lithosphere.
2. A scientist who studies the earth is known as a geologist.
3. Limestone is deposited in layers on ocean bottoms.
4. Granite is an igneous rock usually containing quartz, mica, and feldspar.
5. When granite is exposed to weathering, the feldspar in it becomes clay.
6. Water and carbon dioxide combine to form an acid which decomposes limestone.
7. About 98% of the earth's crust is composed of eight elements.
8. The hardest common mineral is quartz.
9. Pumice, obsidian, basalt, and granite are common igneous rocks.
10. The basic rocks of the earth are igneous.
11. Shale, sandstone, and limestone are common sedimentary rocks.
12. Oxygen is the main element making up the earth's crust.
13. Some important properties used to identify minerals are streak, luster, fracture, cleavage, and hardness.
14. Quartz comes in several colors.
15. To determine the streak of a mineral, rub it on a porcelain plate.
16. The tendency of a mineral to split easily along a flat surface is called cleavage.
17. Rubbing a mineral on glass to see if it will leave a scratch will help determine its hardness.
18. A mineral noted for its one perfect cleavage is mica.
19. The specific gravity of a mineral is found by comparing its weight with the weight of water.
20. Calcite can be identified by the acid test.
21. The gas given off during the acid test is carbon dioxide.
22. Fool's gold is a mineral known as pyrite.
23. You can tell which of two rocks is the hardest by trying to scratch one with the other.
24. A mineral that fizzes during the acid test is calcium carbonate.
25. The bedrock of the Marshalltown area is mostly limestone.

38a. Minerals in specimen distributed at random (no definite pattern) . . . . . 39a or 39b

39a. Light colored minerals predominate . 40a or 40b

40a. Crystals ½ inch or less in length . . . . . 41a or 41b

41a. A mixture of feldspars, quartz, and mica or hornblende . 42a or 42b

42a. Some crystals of relatively same size . . . . . GRANITE

42b. Some crystals large surrounded by small crystals . . . . . POROHYRY

41b. No quartz present . . . . . SYENITE

40b. All crystals larger than ½ inch in size . . . . . PEGMATITE

39b. Minerals dark in color, dark green and black predominates . . . . . GABBRO

38b. Minerals arranged in planes or bands . . . 43a or 43b

43a. Specimen will usually split along these planes (bands are parallel) . . . . .44a or 44b

44a. Predominant minerals mica and quartz . . . . . MICA-QUARTZ SHIST

44b. Needle-like crystals dark in color; the chief mineral . . . . . HORNBLENDE OR HORNBLENDE SHIST

43b. Specimen does not break along the bands or planes (bands may not be perfectly parallel) . . . . . GNEISS

37b. Particles in specimen are not interlocking . . . 45a or 45b

45a. Specimen composed of pebbles; pebbles may be angular instead of rounded . . . . . 46a or 46b

46a. Specimen composed of round pebbles . . . . . CONGLOMERATE

46b. Specimen composed of angular pebbles (sharp angles) . . . . . BRECCIA

45b. Specimen not composed of pebbles . . . . . 47a or 47b

47a. Particles are of sand size and composed of quartz . . . . . SANDSTONE

47b. Particles sand sized and tightly cemented with quartz so that there are no air spaces between grains . . . . . QUARTZITE

Page 4 SET NO. _____ LAB #1 LAB #2 LAB #3 LAB #4

	COLOR	STREAK	HARDNESS	CLEAVAGE	CRYSTALS	LUSTER	FRACTOR	ACID TEST	WHAT FORM IS IT	NAME
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

36b. Particles can be seen with the aid of a microscope - fine grained . . . . . 48a or 48b

48a. Particles rounded and sand-like . . . . . SANDSTONE

48b. Not as in 48a . . . . . 49a or 49b

49a. Specimens light colored (red, blue, gray, or white) . . . . . 50a or 50b

50a. Exceedingly small quartz grains cemented together (no distinct grains) . . . . . QUARTZITE

50b. Very small feldspar and quartz crystals visible . . . . . FELSITE

49b. Specimens dark colored; not glassy (green or black). . . . . 51a or 51b

51a. Specimen all evenly dark . . . . . BASALT

51b. Specimen dark with pockets of minerals in it . . . . . 52a or 52b

52a. Pockets rounded . . . AMYGDOLOIDAL BASALT

52b. Pockets angular . . . PORPHORITIC BASALT

ROCK COLLECTION

Supplemental Activity #3

1. Collect 1 good example of each of the major kinds of rock.
2. The collection must contain 10 samples, no more--no less.
3. Label each rock and <u>display it in an attractive manner</u>.
4. On a 3 x 5 card write a brief description of each rock collected--telling:
    1. Name
    2. Where you got it.
    3. When you got it.
    4. What type it is (igenous - metamorphic - sedimentary or mineral)
5. Bring your collection to school to be displayed for a day and to be checked by an instructor.

THE CHANGES IN THE EARTH

NAME _____

CLASS _____

TEST DATE _____

TEXTS: Modern Science, Earth, Matter and Space

Modern Science I

Earth Science, The World We Live In

Our Environment

* * * * * * * * * * * * * * REQUIREMENTS * * * * * * * * * * * * * *

☐ 1. Study in Modern Science, Earth Matter and Space pp. 317-339 Answer the questions on page 326.

☐ 2. Look at pp. 88-235, 324-353 in Earth Science, The World We Live In.

☐ 3. Study Our Environment pp. 279-281. Answer "Check Up" questions on page 281.

☐ 4. Write a short meaning to "Words to Remember" on p. 396 in Modern Science I.

☐ 5. Do Required Activity "Settling Rate of Rocks and Soil."

☐ 6. Do Required Activity "Pressure on Ice".

☐ 7. Construct a "Contour Map of Plastic Mountain". (Page 8)

☐ 8. Write answers to "Current Science" questions as assigned.

* * * * * * * * * * * SUPPLEMENTAL ACTIVITIES * * * * * * * * * * *

○ 1. Prepare a model fossil. (Page 9)

○ 2. The Changes in the Earth. (Pages 10 to 14 in this LAP.)

○ 3. Speed of Earthquakes. (Page 15 & 16)

○ 4. Rock Layers Tell a Story. (Page 17)

○ 5. Plant Acid and Rocks. (Page 18 & 19)

○ 6. Rock Abrasion. (Page 20)

○ 7. Stream Action. (Page 21)

○ 8. Individual projects such as Bulletin Board - Prepare a crossword puzzle - Make a volcano.

○ 9. Topographic Map Reading. (Page 22)

○ 9½ Stalactites and Stalagmites. (Pages 23 & 24)

10. Do the Crossword Puzzle on Page 25 of this LAP.

FILMSTRIPS:

#7501	"Discovering Fossils"
#7502	"The Story Fossils Tell"
#7503	"The Coming of Reptiles"
#7504	"The Rise of Dinasaurs"
#7505	"Triumph of the Dinasaurs"
#7506	"Age of Mammals"
#A 431-7	"The Earth's Crust"
#A431-15	"Volcanoes and Earthquakes"
#FSG 7.2	"Streams and Rivers"
#FSG 7.2	"Glaciers"
#A431-16	"Mountains"
#2	"Our Earth is Changing"
#4	"The Story of the Earth We Find in Rocks

STEREOGRAMS — Go through and look at the pictures and read the captions in Aerial Stereograms, or the Stereogram Book of Fossils. Ask the librarian for them and a viewer.

TAPE RECORDINGS — Listen to tapes of reading assignments from Modern Science, Earth, Matter and Space. Tape A is pages 317-326 and tape B is 327 - 339.

* * * * * * * * * * * * * * * * *GRADES * * * * * * * * * * * * * * * * *

For a C - Do requirements.

For a B - Do requirements plus two Supplemental Activities.

For an A - Do all requirements plus any four Supplemental Activities.

Pages 10-16, 23, 24 of this Learning Activity Package were adapted from Blanc and Fischler, Exercises and Investigations for Modern Science, Earth, Matter and Space. Holt, Rinehart and Winston, Inc. 1967.

BEHAVIORAL OBJECTIVES

1. The student will be able to select, at 90% efficiency, the correct answer on a multiple choice test question over the difference between weathering and erosion.

2. The student will be able to list and define three agents of erosion.

3. The student will be able to list and define three agents of weathering.

4. The student will be able to list the four main types of mountains and recognize from a short paragraph, which of these is being described.

5. The student will be able to show his ability to define and use the vocabulary words on page 396 of Modern Science I by his correct response to 75% of given multiple choice questions.

6. After completion of required activity #6 the student will be able to state in writing the cause of the changes that took place under pressure.

7. After he has finished supplemental activity #5 the student will write, in answer to a question, that the plant gave off the acid that was found in the water.

8. After doing supplemental activity #5 the student will use litmus paper to test, at a 100% level of performance, the presence of acid in a solution.

9. After completing required activity #5 the student will state, in writing, that the water can not carry large rocks as far a small ones.

10. After finishing supplemental activity #1 the student will be able to mix and use plaster in model making.

11. Upon completion of required activity #7 the student, given a 3-dimensional object, will be able to construct a contour map of the object.

12. The student, after finishing supplemental activity #3 and when given adequate information, will be able to state in writing, the method used to locate the epicenter of a earthquake.

13. After doing supplementary activity #6 the student will be able to determine the mass, within one-tenth of a gram, of any object given to him.

14. After finishing supplementary activity #6 the student will be able to state in writing what the effect is when rocks collide.

IMPORTANT FACTS AND IDEAS ABOUT THE CHANGES IN THE EARTH

1. Scientists believe that the Earth was formed from the same kind of material as our sun.

2. We do know that many of the elements found on earth are present in the sun and other bodies of the solar system.

3. The scientific hypothesis most widely accepted about the earth's origin, states that the earth was a mass of rock and gases and the force of gravity pulled it into a huge ball.

4. Masses of boiling rock are thought to have been one of the main sources of the air and water of today.

5. As the earth's surface cooled the atmosphere cleared and the sun's energy produced changes in the oceans that led to the first forms of life.

6. Scientists have been able to estimate the age of the earth from the amount of radioactive decay in rocks.

7. The time it takes for half of the atoms of a given amount of radioactive element to decay is called its half life.

8. Rock layers and fossils remains have been used to determine a geologic timetable of the earth's history.

9. Geologic time is divided into five main eras: (a) Azoic, (b) Proterozoic, (c) Paleozoic, (d) Mesozoic, (e) Cenozoic.

10. The appearance of the first dry-land forms of life was in the Mesozoic Era so this is called the Age of Reptiles.

11. The Cenozoic Era is the time of modern life or the Age of Mammals.

12. Folded mountains are formed when internal pressures cause parts of the earth's furface to rise and wrinkle lifting and folding rock layers into mountains.

13. Huge blocks of the crust may move up and down, usually along breaks in the surface called faults, and the movement can form block mountains.

14. Dome shaped mountains are formed when molten material forces its way up toward the surface and causes an area of the crust to rise.

15. The molten material that flows out from a volcano is called lava.

16. Earthquakes seem to occur along definite fault lines in the earth.

17. The sudden movement in the earthquake releases energy, which moves through the earth in waves.

18. Weathering is caused by water when it freezes because it expands and produces great pressures.

19. Temperature changes cause weatherling in rocks by expansion and contraction.

20. Water seeping through the ground produces weathering by dissolving minerals from the soil and decayed plant or animal remains.

21. Weak acids produced by growing plants helps to dissolve and break down soil minerals.

22. Erosion is the transporting of rock fragments from place to place.

23. Weathering is the action that breaks rocks into fragments.

24. Sand and soil carried by strong winds hits rock with such a force it can cut it away.

25. The force of flowing water wears rocks away.

26. The size of rock that can be carried by water depends on the velocity and the gradient of the stream.

27. Glaciers moving slowly over the earth are carving out and smoothing the earth's surface.

28. When snow doesn't melt but accumulates and packs down year after year the pressure changes it into ice called a glacier.

29. As the ice melts the material carried by the glacier is deposited in formations called morraines.

REQUIRED ACTIVITY #5

SETTLING RATE OF ROCKS AND SOILS

Have you ever noticed different layers of material in a deep ditch or an eroded hill-side? This layering is called a profile. You can easily make a model that is much like the soils profiles you have seen in nature.

Procedure

Fill a test tube 1/3 full of sand, clay and gravel. Mix marked "Settling Rate Mix", add water until the tube is 3/4 full. Shake the tube until all the materials have been mixed thoroughly. Then hold it very still.

Watch the tube until the material settles and the water is clear if possible. How long did you wait? _____

Look in Earth Science - The World We Live In on page 56 topic B.

Answer these questions:

1. What do you see as you examine the contents of the test tube?

   _____

2. What are the approximate sizes of the materials in each layer?

   _____

3. Apply what you see here to the layers of sediments found in a stream bed. _____

   _____

4. What is the reason that some materials settle out faster than others? _____

5. See film loop "Settling Rate." _____

REQUIRED ACTIVITY #6

Pressure on Ice

If you could see the bottom of a glacier you would see flowing water and many rocks. Now just guess at an answer to the two following questions and write your answer in the space provided. How can this water be melted? _____

Where does all the rock come from? _____

In this experiment you will discover what happens to crystals of frozen water under great pressure.

Procedure for the experiment - This will be set up in class.

You will need a block of ice, a piece of wire, and two metal weights. Fasten the weights to the wire and place the wire over the top of the block of ice so the weights hang at opposite sides of the ice.

After 5 minutes has there been any change in the ice under the wire? _____ What is the change? _____

If there is no change wait longer. What happens after 30 minutes?

_____

What does pressure do to ice? _____

Perhaps you should write new answers to the questions you answered after watching the ice block.

1. What are the two forces that cause glaciers to move? _____

_____

2. Where do some of the rocks found in morraines come from? _____

_____

REQUIREMENT #7

CONSTRUCT A CONTOUR MAP OF A PLASTIC MOUNTAIN (See film loop, Contour map of plastic mountain.)

The first thing you will need to do is find out what a contour map is. You can start by studying pages 75-77 in Earth Science - The World We Live In.

Pick up your plastic mountain kit from an instructor. Inside the box you should also find a color and a clear sheet of plastic. Now add water to the plastic box until it is 1½ centimeters deep. Next make a mark around the mountain right at the water level. Add another 1½ centimeters of water and repeat until the entire mountain is covered with water.

Next, dump water down a drain and place the lid on the box and then tape the clear plastic sheet to the top and trace the lines from the mountain on to the plastic sheet. Take the map to an instructor to be checked. When it has been approved wipe it clean and replace it.

PITFALLS AND CAUTIONS!!!!!!!!!!!!

1. The model mountain may float. Hold it down in some way.
2. Be sure the marking tool you use will not wash off with water.

DO NOT USE A DRY MARKER!!!

SUPPLEMENTAL ACTIVITY #1

MAKE-A-FOSSIL

In this activity you will be using casting plaster and old shells or bones for fossil like impressions. To prepare the plaster mix it with small amounts of water in a paper cup until it is the consistency of thin paste. If you mess around too long, before the next step, the plastic will harden on you. You can bring your own sea shell or bone, or get one from an instructor. Before placing the shell in the plaster, cover it with a very, very thin coat of petroleum jelly you can get from an instructor.

Mark your paper cup and allow it to stand over night. You may wish to paint your fossil to make it look more real.

To complete this project you must do three things:

1. Show the fossil to an instructor.
2. Have written on piece of paper the type of fossil you have made (be as exact as you can). Use a fossil book to help you identify it.

CLEAN UP THE MESS!!!!!!!!!

DON'T TOUCH ANYONE ELSE'S CUP !!!!!!!

SUPPLEMENTAL ACTIVITY #2

A. WHAT IS THE EARTH'S HISTORY? Pages 317 - 326

1. (a) What force is thought to have pulled together the materials that made up the earth in the beginning? _____

(b) What is thought to have been the result of this pulling together of materials? _____

_____

2. According to the hypothesis referred to in question 1, where did the water and air on the earth come from? _____

3. From what three clues did earlier scientists attempt to figure out the age of the earth? (a) _____

(b) _____

(c) _____

4. What two methods, based on the decay rate of radioactive materials in the crust, have been used to determine the age of the earth more accurately? (a) _____

(b) _____

5. How old do scientist now believe the earth to be? _____

6. In the spaces at the right of Fig. 12-1, which shows fossils in layers of rock, label which layer is the <u>oldest</u>, which is the <u>next oldest</u>, and which is the <u>youngest</u>.

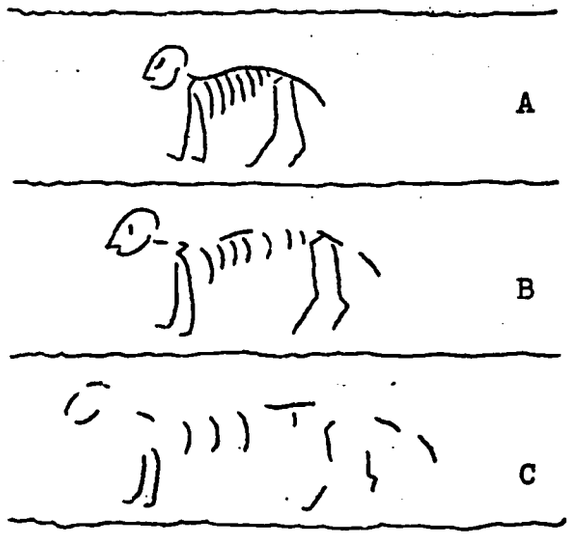


Fig. 12-1

A _____

B _____

C _____

7. (a) What happens to the carbon intake when a living organism dies? _____

(b) What happens to the radioactive carbon atoms in the tissues of dead organisms? _____

(c) What methods of dating fossils does this allow us to use? _____

8. (a) How long ago is the Archezoic Era thought to have begun? _____

(b) What types of life may have been present in that era? _____

9. (a) How long ago is the Proterozoic Era thought to have begun? _____

(b) What types of life may have been present in that era? _____

10. (a) How long ago is the Paleozoic Era thought to have begun? _____

(b) What is the most common fossil from this era? _____

11. (a) During which era were the giant reptiles, or dinosaurs, living? _____ (b) What is the most common fossil from this era? _____

12. (a) In which era are we now living? _____ (b) What main form of animal life developed during this era? _____

Tell what each term means.

radioactive element _____

_____

paleontologists _____

_____

geologic timetable _____

_____

Ice Ages _____

Summary: Briefly explain what you have learned in this activity.

B. HOW HAVE INTERNAL FORCES CHANGED THE EARTH? Pages 327 - 332

1. (a) If you were to balance two pans of water on a laboratory balance, and you poured a little sand into one pan, what would happen to the balance of the two pans? _____

_____

(b) What process of change in the earth's surface does this illustrate? _____

_____

2. (a) As the weight of the layers of sediment deposited in the oceans increases, what happens to that part of the earth? _____

_____

(b) What forces are produced on the mantle of the earth by this action? _____

(c) What kind of mountains may have been formed in this process?

_____

3. (a) What kind of mountains are formed when great blocks of the earth's crust are raised? _____ (b) Along what kind of geological formation does movement of this kind usually take place? _____

4. What kind of mountains may be formed by the pressure of the mantle forcing a weak spot in the crust to rise? _____

5. (a) What activities deep in the earth may produce a volcano?

_____

_____

(b) What is the name of the molten material that flows from a volcano? _____

6. Why are scientists trying to learn more about volcanoes? _____

_____

7. What are earth tremors? _____

8. What two destructive results may be produced by a severe earthquake? (a) _____

(b) _____

9. What does a seismograph record? _____

_____

10. Which type of shock wave produced by an earthquake (a) moves at the greatest speed through the earth? _____

(b) does the damage in a severe earthquake? _____

Tell what each term means.

folded mountain _____

_____

block mountain _____

_____

dome mountain _____

_____

volcano _____

_____

earthquake _____

_____

Summary: Briefly explain what you have learned in this activity.

C. HOW HAVE EXTERNAL FORCES CHANGED THE EARTH? Pages 333 - 339.

1. (a) What substance is formed as rocks break down into small pieces in weathering? _____ (b) What important substance does this form when mixed with organic materials? _____

2. What kind of geological formation may be produced by ground water seeping through limestone layers over a long period of time? _____

3. Name the two kinds of mineral deposits often seen in underground caves in which water drips from the roof. (a) _____ (b) _____

4. Name a National Park famous for the unusually shaped rocks formed by wearing away by wind. _____

5. How can dune formation be controlled? _____

_____

6. Name the two kinds of glaciers. (a) _____ (b) _____

7. Which kind of glacier changes the earth's surface more? _____

8. In what National Park are glaciers in existence today? _____

Tell what each term means.

weathering _____

_____

erosion _____

_____

delta _____

_____

glacier _____

_____

SUPPLEMENTAL ACTIVITY #3

SPEED OF EARTHQUAKES

PROBLEM

Seismographic stations are used to detect and record vibrations in the earth's crust caused by earthquakes. Most earthquakes are recorded at several stations, and the center of the earthquake can be figured out. How can the speed of earthquake waves be determined?

INVESTIGATION

Instruments at several seismographic stations recorded a shallow earthquake that took place near Guatemala City in Central America at exactly 12 hours, 36 minutes, 20 seconds (12:36:20) on the afternoon of a certain day. This earthquake caused a series of waves to be recorded. The information for the time and the distance from the earthquake center is given in the following table. Determine the approximate speed of the P wave at each station. (Remember, speed = $\frac{\text{distance}}{\text{time}}$. Answers should be rounded off to the nearest whole numbers.)

Record of Primary P Wave

Location of station	Arrival times of P wave at station	Travel times of P waves	Distance from center of earthquake	Speed of P wave in miles per minute
Mexico City, Mexico	12:38:00	0:1:40	825 miles	
Pasadena, California	12:41:40	0:5:20	2350 miles	
Buenos Aires, Argentina	12:45:35	0:9:15	4000 miles	
Fairbanks, Alaska	12:46:20	0:10:00	4325 miles	
Rome, Italy	12:49:05	0:12:45	6350 miles	

INTERPRETATION

Complete each statement by writing the correct word in the space at the right.

1. The approximate speed in miles per minute of the P wave recorded at Mexico City is _____ miles per minute. _____

2. Earthquake waves that travel at the fastest rate in a straight line through the earth are called _____ waves. _____

3. The closer the recording station was to the center of the earthquake, the _____ was the recorded speed of the P wave. _____

4. The approximate speed in miles per minute of the P wave recorded at Fairbanks is _____ miles per minute. _____

5. Earthquake waves that travel at the slowest rate along the surface of the earth are called _____ waves. _____

6. When primary and secondary waves reach the surface they are usually _____ back into the earth. _____

7. The average speed in miles per minute of the P wave recorded at all five stations is _____ miles per minute. _____

8. The farther the recording station was from the center of the earthquake, the _____ was the recorded speed of the P wave. _____

9. The average speed in miles per second of the P wave recorded at all five stations is ____ miles per second. _____

10. As a primary wave travels outward from the center of the earthquake, the _____ of the crust causes its speed to decrease. _____

APPLICATION

Explain how the time interval between the recording of the primary wave and the long wave is used to find out how far the center of the earthquake is from the seismographic station.

SUPPLEMENTAL ACTIVITY #4

ROCK LAYERS TELL A STORY

The crust of the earth is made up of many layers of bedrock. Originally these layers were horizontal, but forces from within and outside the earth have changed these layers so they are no longer completely horizontal. The layers may have been faulted, folded, eroded, or lifted. If these layers can be examined, they tell the history of changes that were made.

In this investigation you will make a model that shows layers of bedrock. This model will show how changes in the bedrock have formed various features in the crust of the earth.

Using four different colors of clay, make a small model of rock layers that have been shifted in some way. Look at pages 182-255 in Earth Science - The World We Live In. Get the clay from an instructor. Use notebook paper between layers so the clay can be reused. In making your model you should consider Faults - Folded Mountains - Domes and Volcanic Mountain, as well as earth quakes. Of course you will not use all of them in the same model.

Answer the following questions about your model:

1. Which layer is the oldest? How do you know?

2. Which layer is next to the oldest?

3. If the model has folded layers when did the folding take place?

4. What caused the folding?

5. Was there a long time lapse between the formation of any of the layers? How do you know?

6. How would you explain one layer that is cutting through another?

SUPPLEMENTAL ACTIVITY #5

PLANT ACIDS AND ROCKS

Often farmers have to add lime to their soil if it contains too much acid. Sometimes acid in ground water will dissolve minerals in the ground and leave hollows or caves in place of former minerals. From past experience, which mineral is easily dissolved by acid?

_____

How does acid get into ground water? This experiment will help answer that question.

PROCEDURE:

Do you know how to use litmus paper to test a solution to tell if it is an acid or a base? You can find out by doing these tests: Your instructor has prepared 2 solutions; one is an acid, one is a base. Touch both red and blue litmus paper to the solutions. Then fill in these blanks.

An acid turns _____ litmus paper _____.

A base turns _____ litmus paper _____.

NEXT test tap water with litmus paper. Is it an acid or base? _____ After testing tap water fill 2 test tubes with tap water. Each should be 2/3 full. Place a young bean seedling in ONE AND ONLY ONE of the tubes. Do not allow the leaves to be covered with water. Then cover up the tops of BOTH with cotton. With a grease pencil write your name on the tube for later identification.

After 2 or 3 days test the water in both test tubes. WRITE OUT the answers to these questions:

1. Was there a change in the water in either test tube? _____
   Which test tube? _____
2. What was the change? _____
   _____

3. What caused the change? _____

_____

4. Why was this a <u>controlled experiment?</u> (For a review of the controlled experiment read pages XXV and XXVI of the Introduction in the book, <u>Modern Science, Earth, Matter and Space.</u>)

_____

_____

_____

_____

5. What was the control? _____ What was the variable? _____

6. What is the source of the acid that dissolves minerals to form underground caverns? _____

_____

7. What kind of rock is the bedrock most likely composed of, if it has many caves and caverns in it? _____

_____

SUPPLEMENTAL ACTIVITY #6

ROCK ABRASION

This is an investigation that will help you discover how rocks are broken up and worn away. You will need 10 rocks, a balance to weigh them on, and a plastic container to shake them in.

PROCEDURE

WEIGH the rocks. You may need help in using the balance for the first time. Then put the rocks in the container and shake it vigorously for 3 minutes.

Remove the rocks from the container. REWEIGH the rocks. But only use the same number you started with. (For instance, if one broke into 3 pieces you could only weigh one of them.)

RECORD your data below.

Number of rocks _____ Shaking time _____

Weight before shaking _____ After _____

Weight lost _____

Answer these questions:

1. What happens to rocks with shaking (Abrasion?) _____

_____

2. Are all rocks affected the same? _____

_____

3. How do the forces of nature act to cause abrasion? _____

_____

_____

_____

4. How do the 2 weights differ? _____

5. What percentage of rock was worn away in the 3 minutes of abrasion? _____

$$\% = \frac{\text{weight lost}}{\text{weight before}} \times 100$$

SUPPLEMENTAL ACTIVITY #7

STREAM ACTION

The water of a stream carried loose materials as it flows. In this investigation you will discover how much loose material a stream will carry and also what happens to the material after being carried away.

PROCEDURE

The stream tables are set up in the greenhouse. These tables contain gravel. The tables are supported so part of each one is raised higher than the rest. If the gravel has been washed into the lower part of the table push it back into the higher part.

Water hoses will be available to supply a steady stream of water. Allow this stream to flow across the gravel and down to the lower end of the table.

The stream of water should NOT be so strong that it washes all the gravel away. Have an instructor adjust the stream for you.

After the stream has flowed over the gravel for a period of time, (perhaps 5-10 minutes) examine the results.

1. What has carried the material down-stream? _____
2. What is the name of the feature built at the end of the stream? _____
3. What is this feature made of? _____
4. Are the different sizes of rock materials all deposited at the same time? _____
5. What is the size that was carried the fartherest? _____
6. How would you set up your own experiments to discover the way the velocity and slope of the stream affect materials carried by water?
7. If you would like to do your own experiments ask your instructor for permission to do so.

SUPPLEMENTAL ACTIVITY #9

TOPOGRAPHIC MAP READING

A topographic map is much like a contour map and similar to the one you made in Requirement #7. Each line on the map represents land at a specific elevation. For example, open a "Sterio Atlas" to plate 5 (Topographic Map of Kettle Creek Region, Penn.) and find a contour line marked "1600". Every point on that line is 1600 feet above sea level and if you were to walk along the line you would neither go up hill or down. On this map the dark lines represent a 200 feet change and the light lines are 50 feet.

Look the map over very carefully and answer the following questions:

1. What is the highest point on the map? _____ feet
2. Which direction is the river flowing? _____ (Be ready to prove it)

Now turn to map set 37. On this map each square box is one square mile or a section and each is numbered. There are 36 sections in each township.

1. Parts of how many townships are shown on this map? _____
2. In section 25 (the only one shown on this map) there is a closed line with hash marks around it. 

   What does this mean? _____

<u>One Map set 10:</u>

1. What is the height difference between each solid line? _____ft.
2. What is the highest point on the map? _____ feet
3. What is the height difference between dotted line? _____ ft.
4. What is the lowest point. _____

<u>Bring the maps when you come to have these checked!</u>

SUPPLEMENTAL ACTIVITY #10

STALACTITES AND STALAGMITES

DO THIS AT HOME !!!!!

PROBLEM

In many underground caves, stalactites and stalagmites of unusual shapes may be seen. These are formed by mineral deposits over the years. How can we demonstrate the factors that produce these formations?

MATERIALS

Two large beakers, heavy cotton cord, glass plate, epsom salts.

PROCEDURE

Dissolve as much of the epsom salts as you can in a quart of warm water by stirring the mixture until no more salt will dissolve. Pour the clear liquid into two beakers and place them on a glass plate. Arrange the cotton cord as shown in Fig. 12-5 so that the ends are in the beakers of salt solution. Leave undisturbed for several days and observe what happens.

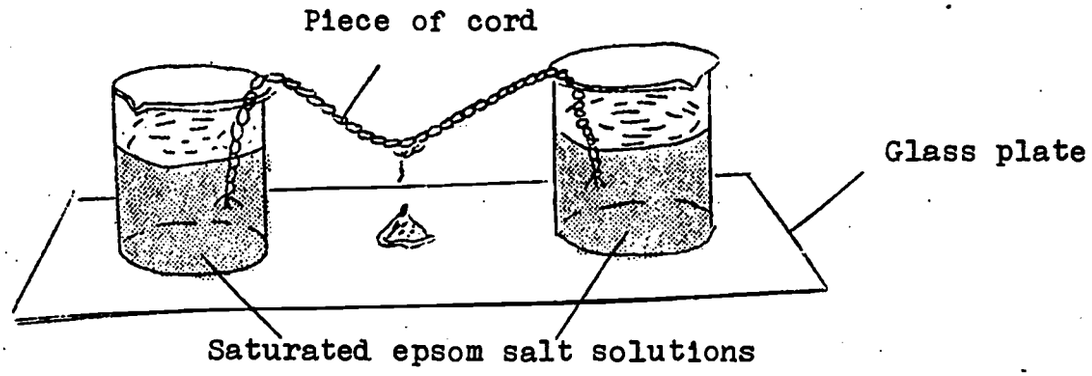


Fig. 12-5

OBSERVATIONS

1. What kind of solution is formed by dissolving as much salt in the water as it will hold? _____

2. What happens to the water as the solution drips from the cord? _____

3. Which part represents a stalactite? _____

4. Which part represents a stalagmite? _____

INTERPRETATION

Some of the following statements are true and some are false. In the space at the right of each statement:

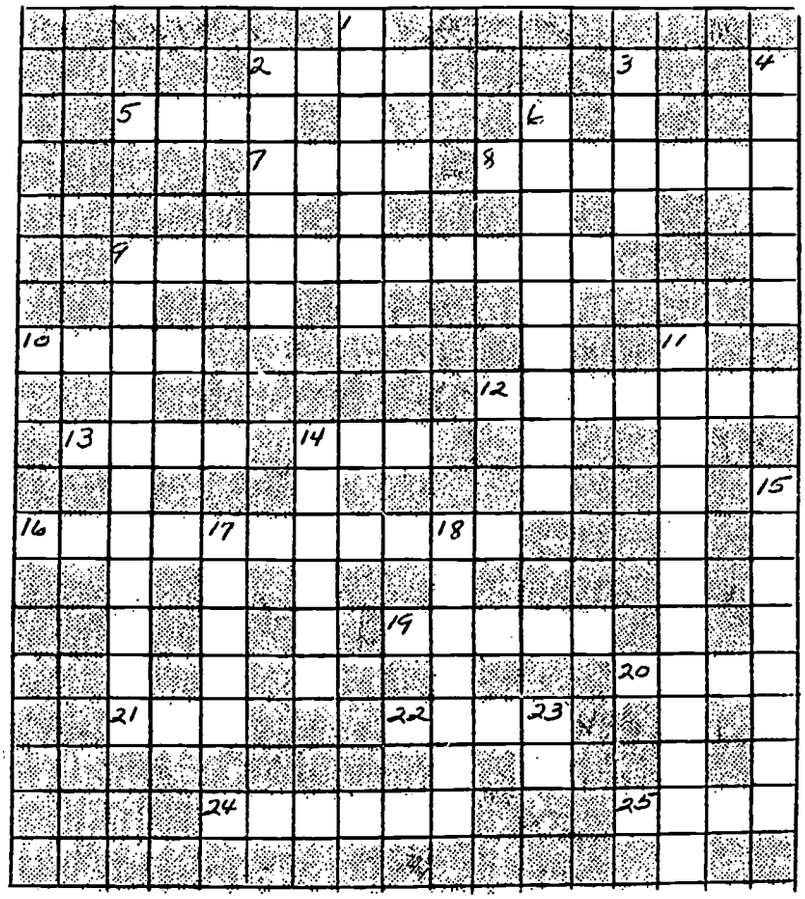
(a) write the correct word for the underlined word if the statement is false
(b) write true if the statement is correct as is.

1. Ground water contains dissolved carbon dioxide from the air. _____
2. The dissolved gases in the water make the water a weak acid. _____
3. Water seeping through the ground dissolves minerals from the rocks. _____
4. Underground caves are usually found in thick layers of granite rock. _____
5. The process in which minerals are dissolved from rock to form caves is called erosion. _____
6. In caves where ground water drips from the roof, stalagmites are hanging down. _____
7. The part of the deposit that builds up on the floor of the cave is the stalactite. _____
8. If the ground water drips from one place for many years, a column may be formed from the floor to the ceiling. _____
9. Minerals may also be deposited on the surface of the ground by water flowing out of an artesian spring. _____
10. Many of the colors seen in minerals deposited on the surface are due to tiny plants in the water. _____

APPLICATION

Explain why limestone or sandstone materials used in buildings become crumbly and break off around the edges after many years of exposure to the weather.

EARTH SCIENCE GEOLOGY



ACROSS:

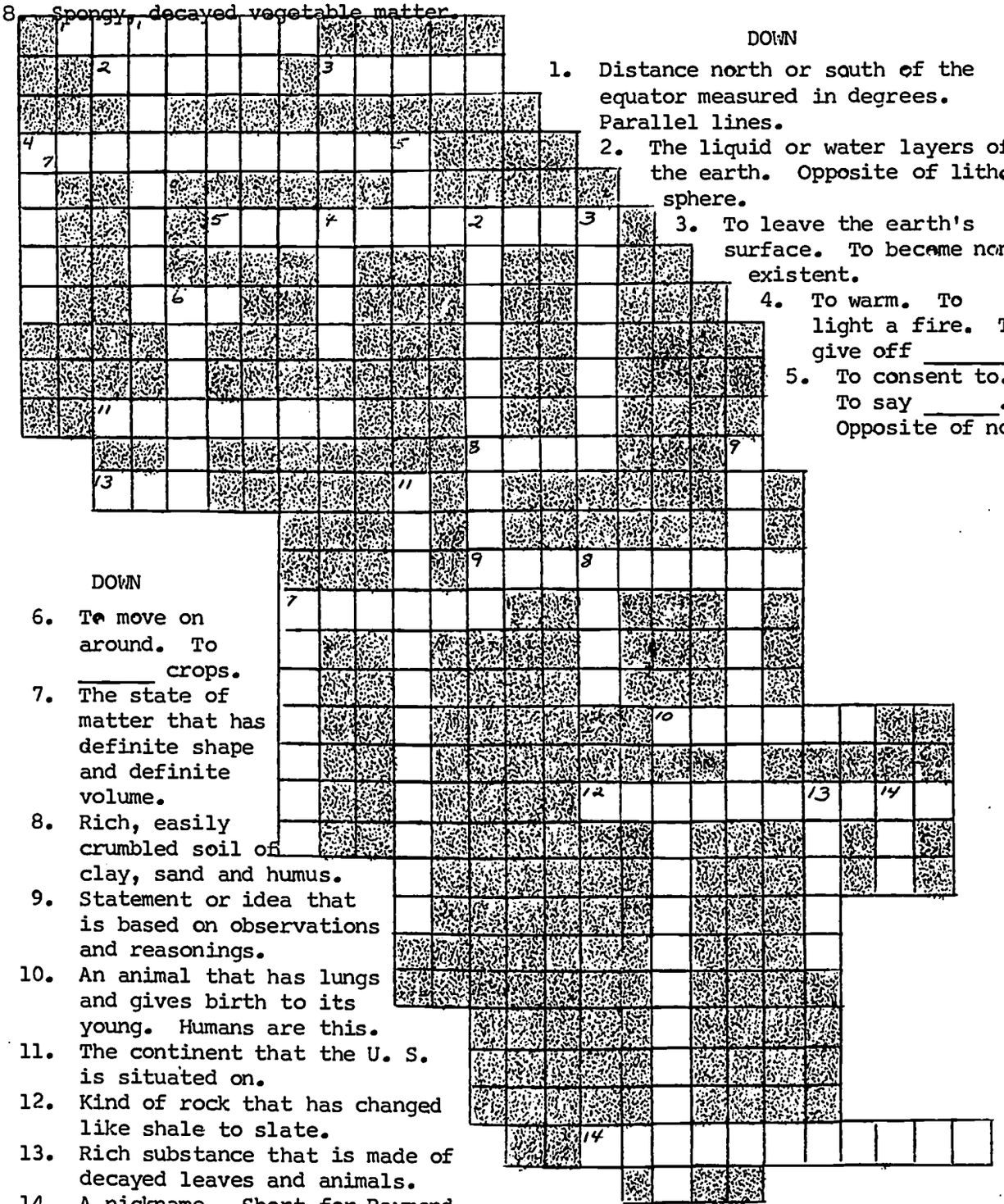
2. A layer of the earth that has been folded out of shape.
5. To do alone
7. Ill or unhealthy
8. The study of the earth. Especially the rocks.
9. Rock formed in layers at the bottom of water.
10. Type of soil. Very small particles of feldspar.
12. Precious stone. Hardness of 10.
13. Small grains of broken rock.
14. Animal that sometimes tries to control nature.
16. Rock type that changed form.
19. Mountain range of S. America.
20. Molten rock coming from earth
21. Large body of water.
22. Soil. Mixture of sand, clay & humus.
24. Cracks in a rock layer.
25. Center part of earth.

DOWN:

1. Slow moving field of ice.
2. Remains or impression of ancient plant or animal.
3. Precious element - used in jewelry
4. Hot water shooting from ground.
6. Turned to stone.
9. Hanging from roof of caves.
11. Wise and careful use of resources.
14. Metamorphic rock - forms from limestone.
15. Hole in earth's surface. Releases pressure.
17. Molten material inside the earth.
18. Fire-made rock.
23. _____, myself, and I.

ACROSS

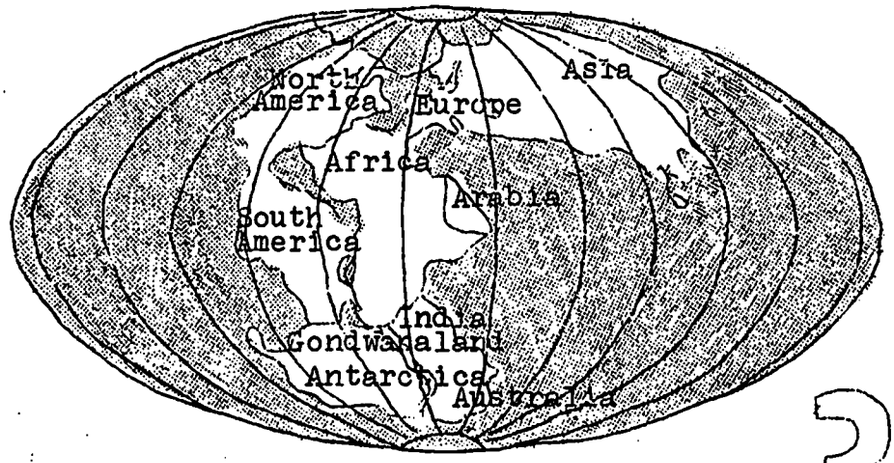
1. Gives off pressure. Molten materials flow.
2. Molten material inside the earth.
3. The outside of the earth.
4. Kind of rock formed in bottoms of oceans.
5. The solid part of the crust:the land.
6. A major division of the earth's history. An _____ of time.
7. The section or layer of earth that lays under the earth.
8. Spongy, decayed vegetable matter. Used sometimes for fuel.
9. Contamination of air, water & land
10. Remains of plants or animals preserved in layers of rock.
11. A large slow-moving mass of snow and ice.
12. The gases and air that surround the earth.
13. The age when the earth was covered with ice.
14. An instrument used to record earthquake waves in the earth.



DOWN

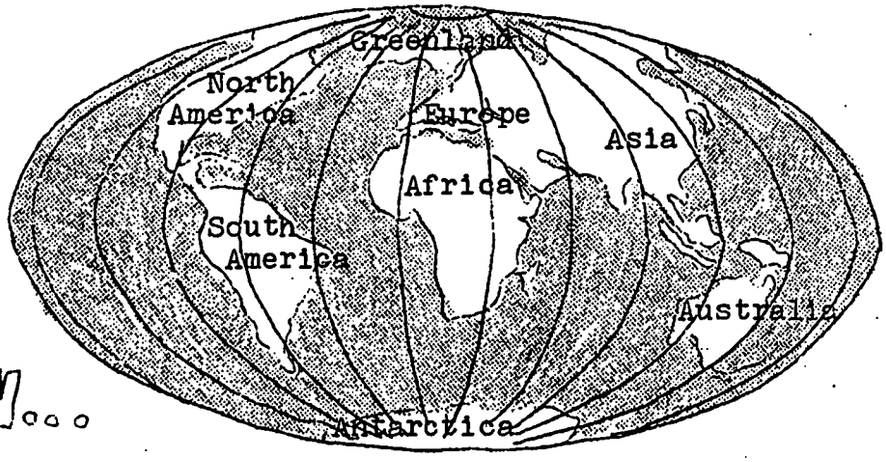
1. Distance north or south of the equator measured in degrees. Parallel lines.
2. The liquid or water layers of the earth. Opposite of lithosphere.
3. To leave the earth's surface. To become nonexistent.
4. To warm. To light a fire. To give off _____.
5. To consent to. To say _____. Opposite of no.
6. To move on around. To _____ crops.
7. The state of matter that has definite shape and definite volume.
8. Rich, easily crumbled soil of clay, sand and humus.
9. Statement or idea that is based on observations and reasonings.
10. An animal that has lungs and gives birth to its young. Humans are this.
11. The continent that the U. S. is situated on.
12. Kind of rock that has changed like shale to slate.
13. Rich substance that is made of decayed leaves and animals.
14. A nickname. Short for Raymond.

CONTINENTAL DRIFT



...THEN

?



NOW...

Listen to TAPE "Continental Drift" and answer the following questions:

1. What was the earliest date given that man speculated about Continental Drift? _____

2. In 1912 who started working on the jigsaw puzzle again? _____

3. List <u>at least</u> 4 pieces of supporting evidence for the theory of Continental Drift on the back of this sheet.

GOLDEN BOY, INC.

G. A. Cunningham
R. L. Iverson
Marshalltown, Iowa

NAME _____

CLASS _____

TEST DATE _____

TEXTS: Modern Science -- Earth, Matter, and Space (Holt)
Earth Science, the World We Live in (ABC)
Modern Science I (Holt)

REQUIREMENTS:

- ◯ 1. Study Modern Science E.M.S. and complete page 4-9 in this LAP
- ◯ 2. Read The World We Live In, pp. 403-423; answer questions #4,7,8 on page 423.
- ◯ 3. Write a short meaning to "Words to Remember" on p. 56 of Modern Science I.
- ◯ 4. Revolution and Rotation Lab. (See page 10)
- ◯ 5. Do "Current Science" questions as assigned.
- ◯ 6. Eclipse Lab. (See page 11)
- ◯ 7. Graphing Lab. (See page 12)
- ◯ 8. Heat Absorption - Reflection Lab. (See pp. 13-14)
- ◯ 9. Ellipse Lab. (See page 15)

SUPPLEMENTAL ACTIVITIES:

- ◯ 1. Sunspot Lab. (See pp. 16 & 17)
- ◯ 2. Size and distances of the planets lab. (See p. 18)
- ◯ 3. Phases of the Moon Lab. (See pp. 19 & 20)
- ◯ 4. Where are you lab. (See pp. 21 & 22)
- ◯ 5. Independent project. (See an instructor)
- ◯ 6. Do the Crossword puzzle. (See page 23)
- ◯ 7. Moon Watch - Details to be announced - The late night place to be.
- ◯ 8. Read pp. 416-433 in the World of Living Things and do "Check your Understanding" on pp. 423, 429, and 434.
- ◯ 9. Review 3 filmstrips and take notes.
- ◯ 10. Check library (school and public) and prepare a 2 page report on one or two of the listed scientists. 1) Cladius Ptolemy, 2) Nicolaus Copernicus, 3) Galileo Galilie, 4) Tycho Brahel, 5) Johannes Kepler, 6) Pierre de Laplace, 7) Issacc Newton, 8) Robert H. Goddard.

GRADES:

1. For a C -- do all requirements
2. For a B -- do all requirements and two supplemental activities
3. For an A - do all requirements and four supplemental activities.

BEHAVIORAL OBJECTIVES

1. The student shall be able to draw a diagram or label a diagram showing relative positions of the sun, the planets, and the planitoids.
2. The student shall be able to describe in writing the 3 main differences between meteors and comets.
3. The student shall know that hydrogen is the main source of the sun's energy and explain in writing the process that takes place in the evolution of this energy.
4. Given a set of conditions and using a tripenesse planetarium, a student shall be able to identify the following: (a) rotation (b) revolution (c) orbit (d) orbital speed (e) an eclipse of the sun (f) eclipse of the moon.
5. The student shall be able to identify the phases of the moon by observing the moon or by using diagrams of the moon.
6. Given a set of conditions and using a globe, the student shall be able to identify the following, (a) longitude (b) latitude (c) Number of time zones (d) Conversion from one time zone to another (e) Equator (f) Prime Meridian.
7. The student shall be able to solve mathematical problems converting statute miles to nautical miles or vice versa.
8. The student shall be able to respond on a multiple choice test to show that he knows: (a) One Rotation - 1 day (b) One Revolution - 1 year.
9. The student shall be able to associate great scientists of the past with their contributions.
10. The student shall be able to list three characteristics of each of the planets.
11. Given a table of planetary data the student shall be able to express the data on a set of graphs.
12. The student shall know the planets revolve about the sun in ellipses and be able to construct an ellipse.

CONCEPTS - GOLDEN BOY

1. The sun is a star composed of hot gases and is the center of our Solar system.
2. The sun gets it's energy from the conversion of hydrogen gas into helium gas. This is a form of nuclear fusion.
3. Sunspots have an 11 year cycle.
4. The solar system consists of the sun, the nine planets, the planetoids, various moons, meteorites, and comets.
5. The planets revolve around the sun in paths called orbits which are elliptical in shape.
6. One trip of a planet around the sun is called revolution. (year)
7. One complete turning of a planet on an axis is called a rotation. (day)
8. The earth rotates in a counter-clockwise direction. (west to east)
9. The moon's period of rotation is the same as its period of revolution so it always has the same side towards the earth.
10. An eclipse of the moon occurs when the moon passes into the earth's shadow.
11. An eclipse of the sun occurs when the moon's shadow falls on the earth.
12. Our clocks and watches run on mean solar time.
13. Time determined by star position is called sidereal time.
14. The earth is divided into 24 time zones.
15. The starting point for the time zones is the prime meridian located through Greenwich, England.
16. East-west position is determined by longitude; north-south position is determined by latitude.
17. Longitude is found by comparing local time with Greenwich time (15 degrees per hour.)
18. Latitude is determined by the position of the North Star above the horizon.
19. Navigational distance is measured in nautical miles.
20. The universal law of gravitation was first formulated by Isaac Newton.
21. Copernicus replaced the earth-centered concept with the sun centered solar system.
22. Galileo first turned a telescope to the sky and found evidence for the Copernican system.
23. Kepler said the planets move in ellipses around the sun and reformulated the three laws of planetary motion.
24. The motion of a planet around the sun is balanced by the gravitational pull of the sun.

HOW DO THE PLANETS MOVE?
(EMS 95-102)

1. Name the three kinds of heavenly bodies which make up the solar system.

   a. _____ b. _____ c. _____

2. In what chief way did the ancient Greek theory of the solar system differ from what we believe today? _____

   _____

3. What did early astronomers notice about planets that was differant from the rest of the stars? _____

   _____

4. How did early man use the apparent motions of the heavenly bodies to mark

   (a) a day? _____

   (b) a month? _____

   (c) a year? _____

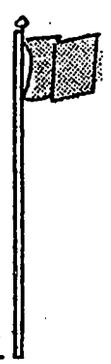
5. How did the Ptolemaic system explain the irregular paths of the planets?

   _____

   _____

6. If the length of the shadow cast by a flagpole on level ground, as seen in Fig. 4-1, were measured once every seven days at the same hour during the fall, you would find that the length of the shadow would change, as shown in the following table:

Date	Length of Shadow
October 2	40 feet
October 9	42 feet
October 16	44 feet
October 23	46 feet
October 30	48 feet



Length of shadow
Fig. 4-1

   As the shadow becomes longer, is the sun higher or lower in the sky? _____

7. At what season is the sun (a) highest in the sky _____

   (b) lowest? _____

8. According to the table in Question 6, into what season is the earth moving?

   _____

9. According to the Copernican system, what accounts for the following: (a) daily rising of the sun? _____

(b) movement of the moon? _____

(c) motion of the planets? _____

10. What new instrument did Galileo use to study the stars and planets? _____

11. Name two instruments used to study the positions of the heavenly bodies before the invention of the telescope? (a) _____ (b) _____

12. How did Kepler explain the motion of the planets? (a) _____

(b) _____ (c) _____

13. Explain briefly the main idea in each of the following hypotheses for the formation of the solar system: (a) the planetesimal hypothesis _____

_____

(b) the tidal-crest hypothesis _____

_____

Tell what each term means:

astronomy _____

astronomical tables _____

earth-centered theory _____

sun-centered theory _____

B. WHAT MAKES UP THE SOLAR SYSTEM? (EMS 102-110)

1. What is the average distance of the sun from the earth? _____

2. In what two forms does the energy of the sun reach the earth? (a) _____

(b) _____

3. With what kind of instrument has the corona of the sun been studied? _____

4. How does the temperature of a sunspot compare with the temperature of the surrounding gases? _____

5. What is thought to be the cause of the Van Allen Radiation Belt around the earth? _____

6. What two types of solar activity may interfere with radio reception on earth? (a) _____ (b) _____

7. What do scientists believe produces the atomic reaction in the sun? _____

_____

8. How many tons of hydrogen are changed into helium each second in the sun's nuclear reaction? (a) _____ (b) How many tons of helium are formed each second? _____ (c) What evidently happens to this loss in weight? _____

9. Name the largest planet in our solar system. (a) _____ (b) What is its period of revolution around the sun? _____ (c) How long is each "day" on this planet? _____

10. Name the smallest planet in our solar system. (a) _____ (b) What is its period of revolution around the sun? _____ (c) How long is each "day" on this planet? _____

11. What evidence is there that Venus moves in an orbit around the sun? _____

_____

Tell what each term means.

solar interior _____

corona _____

nuclear fission _____

nuclear fusion _____

orbit _____

C. WHAT OTHER BODIES ARE IN THE SOLAR SYSTEM? (EMS 111-120)

1. Why is the moon said to be a satellite of the earth? _____

_____

2. What is the average distance of the moon from the earth? (a) _____

(b) What is the moon's diameter? _____

3. If you were to roll a ball of modeling clay one inch in diameter to represent the size of the moon, you would find it would take about 81 balls that size combined to form a ball four inches in diameter. How many times greater is the diameter of the earth than that of the moon?

_____

4. How many times greater is the volume of the earth than that of the moon? _____

5. Name four features of the moon that can be seen with a telescope. (a) _____

(b) _____ (c) _____ (d) _____

6. Why is the moon seen in different phases? _____

_____

_____

7. Why does the moon take 29½ days to go through its monthly phases if its time of revolution around the earth is actually 27 1/3 days? _____

_____

8. Suppose you had a camera pointing at the moon and you took a series of eight pictures about 30 minutes apart without moving the camera or changing the film. In the box at the right, make a drawing showing the path of the moon.

9. What causes an eclipse of the moon?

_____

_____

_____

10. Why doesn't an eclipse of the moon take place each month? _____

_____

11. Of what are most meteors made? _____

12. About how high above the earth do most meteors begin to burn? _____

13. Of what are most comets made? _____

14. In what part of our solar system are most asteroids seen? _____

_____

Tell what each term means.

satellite _____

eclipse _____

meteorites _____

comet _____

asteroid _____

D. HOW ARE TIME AND POSITION DETERMINED? (EMS 120-129)

1. In what direction does the earth turn on its axis? (a) _____

   (b) In what direction does the sun move across the sky? _____

2. What position of the sun in the sky marks noon on the earth? _____

3. Why is the time shown on a sundial not accurate at different times of the year?

   _____

4. How is time measured (a) by the sun? _____

   (b) by the stars? _____

   (c) by atoms? _____

5. If a cardboard tube is fastened around a flashlight and the flashlight is arranged so that it shines on a globe of the earth, as seen in Fig. 4-2, the changing of time on the earth can be illustrated. If the brightest light is shining on the British Isles, what time of the day does this illustrate there?

   _____

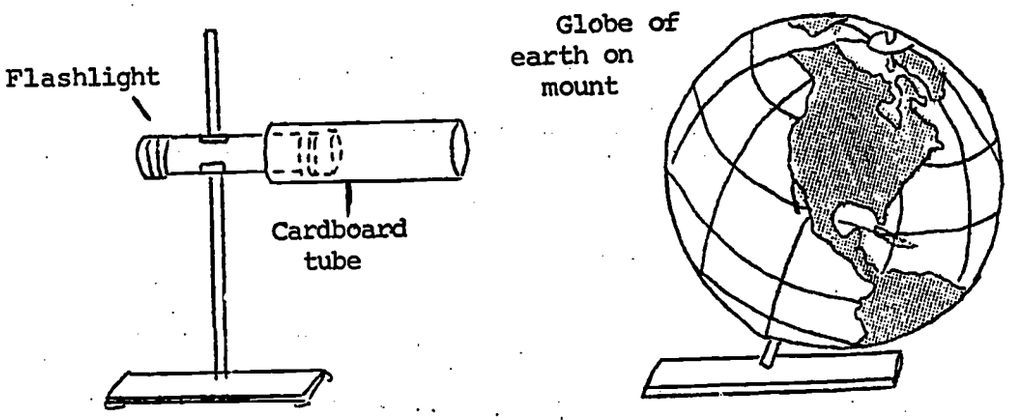


Fig. 4-2

6. Name the meridian of longitude that passes through the British Isles_____

7. If the globe in Question 5 is turned from west to east, through how many degrees must the earth rotate to cause one hour's difference in time? _____

8. Into how many standard time zones is the earth divided? _____

9. What happens when you cross the international date line (a) from east to west? _____ (b) from west to east? _____

10. How is longitude determined? _____

11. If it is 1:00 p.m. in New York City, what time is it (a) in London? _____

(b) in San Francisco? _____ (Compare standard times in each case.)

12. Fig. 4-3 shows the position of three ships in the Atlantic Ocean. Assume the navigators have just "shot" the sun and it is noon at the point where each of the ships is. The Greenwich time is given for each ship. At what longitude west of the prime meridian is the location of

(a) ship A? _____ (b) ship B? _____ (c) ship C? _____

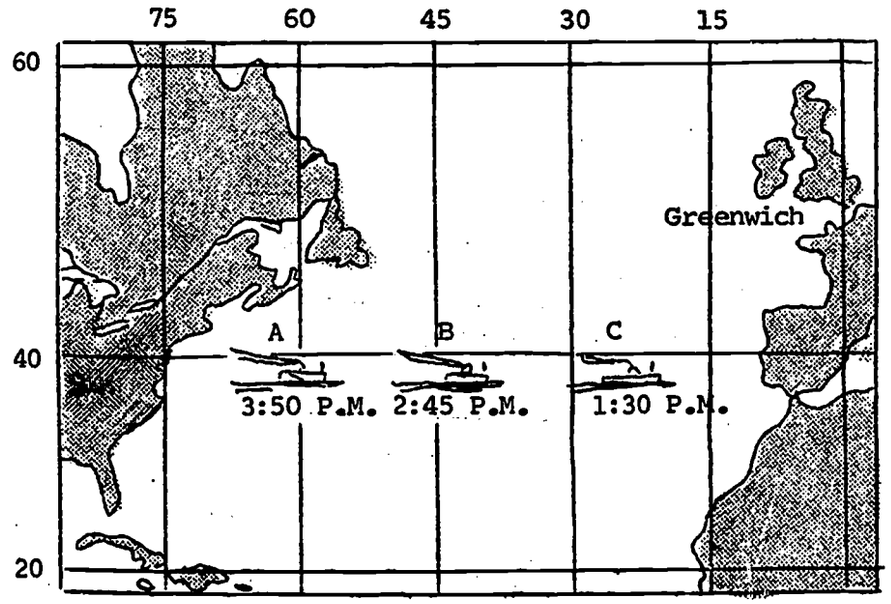


Fig. 4-3

13. About how many nautical miles from Greenwich, England, is (a) ship A? _____

(b) ship B? _____ (c) ship C? _____

14. How is latitude determined? _____

Tell what each term means.

mean solar time _____

time zones _____

longitude _____

latitude _____

nautical mile _____

Pages 4-9 and 18 are adapted from Blanc and Fischler, Exercises and Investigation for Modern Science Earth, Matter and Space, 1967 Holt, Rinehart and Winston, Inc. pp. 35-42

REVOLUTION - ROTATION

One trip around the sun is known as a revolution and marks the length of one year on a planet. The turning of a planet on an axis is called rotation. One rotation represents one day for a planet.

Study the drawing in Figure 1-20 pages 36 of M.S.I. to understand how to do this activity. Get a partner and go through the following motion.

1. one rotation
2. one revolution
3. Revolution and one rotation at the same time.
4. One revolution without rotation.
5. Two rotations during one revolution.

Be prepared to demonstrate these movements.

Answer these questions:

1. Which movement is rotation?_____
2. Which movement is revolution?_____
3. What is the direction of revolution?_____
4. What is the usual direction of rotation?_____

   What planet is an exception?_____
5. What is peculiar about a planet that rotates once as it revolves once?_____
6. What motion represents a year?_____
7. What motion represents a day?_____
8. What is the period of rotation for Mars?_____
9. What is the period of revolution for Mars?_____
10. Which planet rotates the fastest?_____
11. Which planet revolves the fastest?_____

ECLIPSE ACTIVITY

PROBLEM: How can an eclipse of the sun and of the moon be demonstrated?

MATERIALS: A Basketball (The Earth)
A tennis ball (The Moon)
A light source (The Sun)

PROCEDURE: 1. In a darkened room, hold the basketball 12 feet from a light source. Have your partner hold the tennis ball 3 feet from the basketball so that it is in the shadow of the earth. This demonstrates an eclipse of the

_____.

2. Keep the sun and the Earth in the same position and move the moon between the sun and the Earth. Does the shadow of the small object cover all the large objects?

_____This demonstrates an eclipse of the_____

1. Why isn't there an eclipse of the moon each month?_____

_____

2. Why are there many more eclipses of the moon than of the sun?

_____

_____

3. During which phase of the moon is a solar exlipse most likely to occur?

_____ A lunar eclipse?_____

4. What features of the sun can best be observed during a solar eclipse?

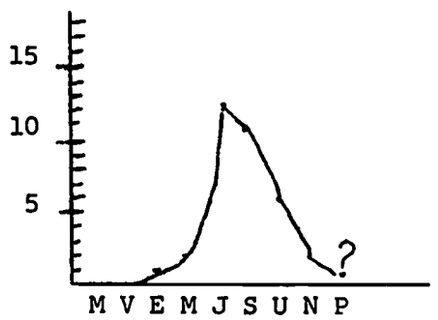
_____

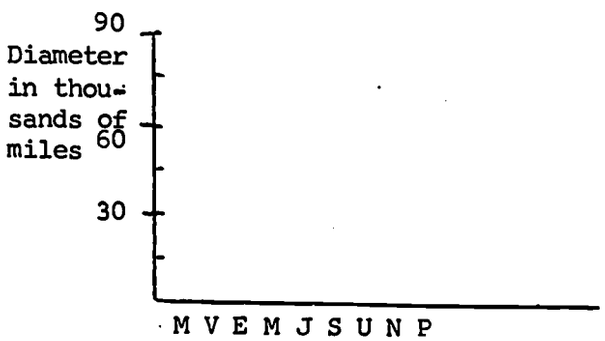
_____

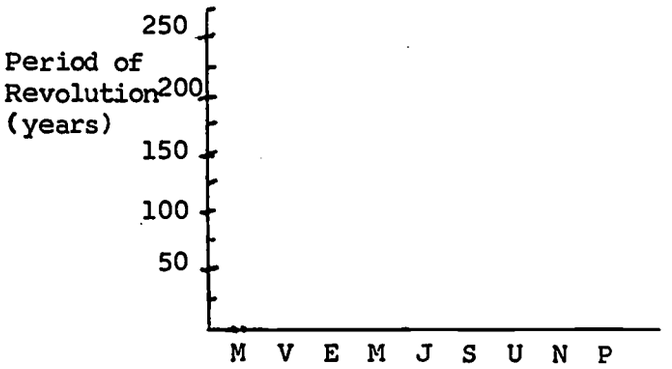
GRAPHING ACTIVITY
Requirement No. 9

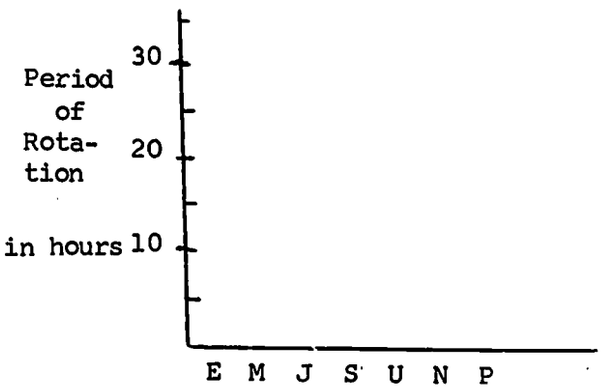
PROBLEM: In this activity you are asked to complete four graphs. The axes of the graphs are marked for you. All you have to do is put dots in the correct places and connect them with a line or curve. Use the chart in "Earth Science - The World We Live In. Page 411.

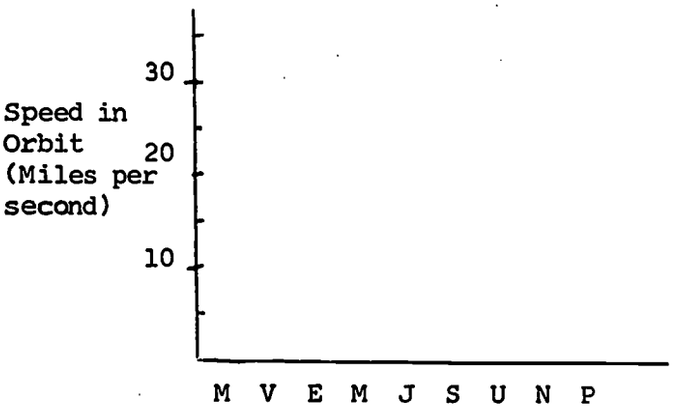
The number of natural moons is on the vertical axis and the planets are listed according to their distance from the sun, along the horizontal axis.











(This information available in other sources.)

HEAT ABSORPTION REFECTION LAB.

Color is a major factor in the absorption as radiant energy. All of our energy from the sun comes to us in the form of radiation. Some of the radiation is absorbed and some is reflected. The earth also radiates heat when its surface temperature is higher than air temperature. If there are clouds they will reflect much of the heat and keep temperatures up. If there are no clouds to reflect, the heat keeps traveling up. This is why clear winter nights are generally colder than cloudy ones. On the other hand if it's cloudy all day the earth never gets heated up.

In this activity you need:

(a) 1 shiny can and styrofoam lid
(b) 1 black can and styrofoam lid
(c) 1 two colored can (use tape) and styrofoam lid
(d) 3 thermometers
(e) a light to supply heat
(f) a time keeper (the room clock will work fine)

Arrange the three cans so they are equal distance from the light Place one thermometer through the slit in each lid, and set each thermometer in the same distance. At the beginning before you turn the light on , all the cans should be the same temperature. Turn the light on and read each thermometer every minute for 25 minutes. Record your data on the chart provided. You may wish to use colored pencils to keep the data straight or you can use a solid line for the black can, dotted for the shiny can and dot-dash for the two colored can.

INTERPRETATION

According to the results of the investigation, mark each of the following statements <u>true</u>, <u>false</u> or <u>not proved</u> in the space provided.

1. The air in the shiny can was warmer than the air in the painted can at the start of the experiment. _____

2. The temperature of the air in the two colored can increased faster than that in the other two cans. _____

3. The temperature of the air in the shiny can increased slower than that in the other two cans. _____

4. The distance each can was from the light bulb affected the temperature of the air in it. _____

5. The temperature of the air in the black can increased faster than that in the shiny can or the two colored cans. _____

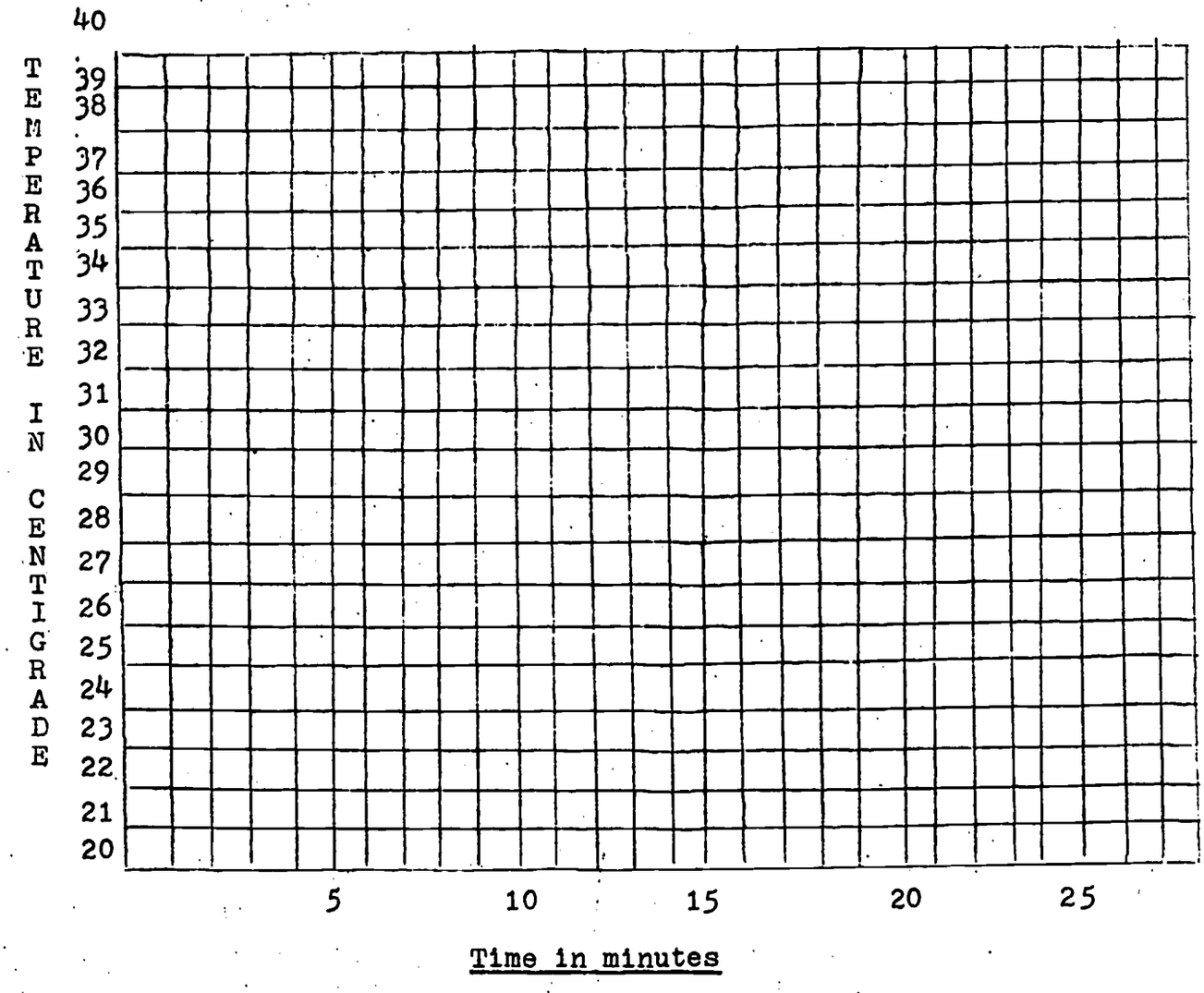
6. The shiny can absorbed more heat in the first 15 minutes of the experiment than in the last 15 min. _____

7. The size of each can affected the temperature of the air in it. _____

8. The temperature of the air in the shiny can increased faster than that in the black can. _____

9. The black can absorbed more heat in the last 15 minutes of the experiment than in the first 15 minutes. _____

10. The color of each can affected the temperature of the air in it. _____



_____Black can _____Shiny can _____2-colored can

ELLIPSE ACTIVITY

PROBLEM: What kind of a geometric figure is an ellipse?

MATERIALS:
A piece of white paper
Two thumb tacks
A piece of string
A pen or pencil.

PROCEDURE:

The main idea in Kepler's Laws is that planets do not move in perfect circles, but rather in ellipses.

1. Fasten a piece of white paper to the bulletin board with two thumb tacks. Do not push the tacks all of theway in.

2. Tie the ends of a piece of string together so that it forms a loose loop under the tacks.

3. With a pencil, trace the outline of the loop as you press the pencil against the string. The shape formed is an ellipse.

4. Make one ellipse on each side of your paper using the same loop of string each time, but move the tacks either closer together or further apart.

CAUTION: Don't make the loop of string too big, the entire ellipse must be on this paper.

A. Which scientist of the past first realized that the planets move in ellipses around the sun?

_____

B. During which portion of its path around the sun is the planet moving the fastest?

_____

C. Does Venus or Earth move faster in its elliptical orbit?

_____

SUNSPOTS

Boiling masses of gas on the sun's surface produce disturbances called sunspots. These sunspots are islands of gases about 1000°C cooler than the surrounding gases. They appear darker because they are cooler. These spots may be 500 to 50,000 miles in diameter. Sunspots die as the sun rotates; some last as long as two months. In this activity you will observe some sunspots. (We hope.)

Materials needed: a telescope
a piece of white cardboard

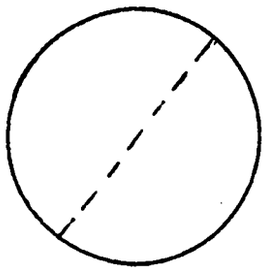
Procedure:

1. Aim the telescope at the sun.
2. Form an image of the sun on a piece of white cardboard with the telescope. Move the lens back and forth until a sharp image is formed on the cardboard. Look for tiny, dark spots on the image. These are the sunspots. Sunspots do not always appear on the sun's surface, so if you do not observe any, try again in a few days.
3. If sunspots are present, record their location on your data sheet.
4. Give each group of sunspots an identifying number the first day.
5. On preceeding days give new groups of sunspots new numbers.
6. Locate and number groups identified on previous observations.

CAUTION: NEVER LOOK DIRECTLY AT THE SUN: BLINDNESS MAY RESULT

DATA SHEET
FOR SUNSPOTS

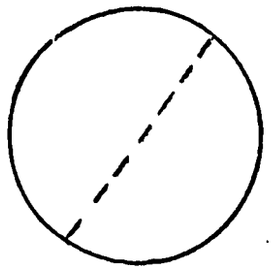
I.



DATE _____

TIME _____

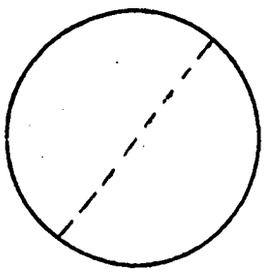
II.



DATE _____

TIME _____

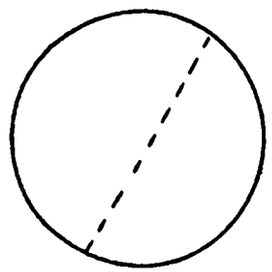
III.



DATE _____

TIME _____

IV.



DATE _____

TIME _____

1. Are there always the same number of sunspots? _____

2. In what direction are the sunspots moving? _____

3. Do they all <u>appear</u> to be moving the same speed? _____

4. How are the spots distributed on the surface of the sun. _____

_____

5. How do sunspots effect us on earth? _____

_____

SIZE AND DISTANCES OF THE PLANETS

PROBLEM: How do the planets compare with each other in diameter and distance from the sun?

MATERIALS: Clay
Meter stick

PROCEDURE:

1. Use the scale of 1mm - 1000 miles to represent the diameters of the planets.

2. Make the clay into balls the correct size to correspond to the 9 planets, and our moon.

A. How do the planets change in size as you go farther from the sun?

_____

B. Use the planetary table in E.M.S. p. 108 and compute the time for a space ship to travel from Earth, at 5,000 miles per hour, to the

moon _____ days

sun _____ years

Jupiter _____ years

Pluto _____ years

C. Following the trend you may have noticed in the solar system, give an approximate size and distance from the sun for planet X beyond

Pluto. _____ diameter in miles, _____ distance from sun in miles. (Use table in E.M.S. p. 108 for your data or Earth Science. p. 411-412)

D. Use the same scale of 1mm-1000 miles, calculate the number of meters between the sun and each of the planets.

Sun to Mercury _____ meters

Sun to Venus _____ meters

Sun to Earth _____ meters

Sun to Mercury _____ meters

Sun to Jupiter _____ meters

Sun to Saturn _____ meters

Sun to Uranus _____ meters

Sun to Neptune _____ meters

Sun to Pluto _____ meters

NOW HOW DO YOU FEEL ABOUT THE "BIG" PLANET EARTH?!!

PHASES OF THE MOON

PROCEDURE: Part A

1. Record the time of moon rise (for our purposes the set occurs 12 hrs. after the rise) for the period of two weeks. (Use an almanac or the daily Register morning paper.)

   A. Calculate the average difference in rising time for the two weeks you have recorded. _____

   B. What causes the differences in rising and setting time to vary from night to night? _____

2. During the time you are doing Part I, go outside each clear night and observe the appearance of the moon.

3. Make a chart, of the phase changes that occur. Include a drawing of the various phases and dates you made the observations.

4. From your data could you determine the period of revolution of the moon? _____

5. If you can, what is it? (From your data) _____

6. If your value differs from the actual value in your book, how can you explain this difference? _____

   _____

7. List any other changes in the moon's appearance that you observed. (Such as color, size, brightness, etc.)

   _____

   _____

   _____

PHASES OF THE MOON
PART B

PROBLEM

As you look up at the sky in the evening, you realize that the appearance of the moon changes from one night to another. At times the moon is "full," and at other times it is completely "dark." How are phases of the moon related to the passage of time?

INVESTIGATION

A student made observations of the appearance of the moon over a period of 30 nights starting on an evening when the moon was completely dark. Some of the phases of the moon and the dates on which they occured according to his observations are shown in Fig. 4-4.

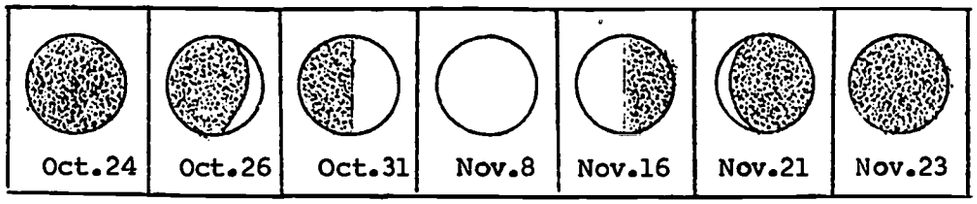


Fig. 4-4

INTERPRETATION

Fill in the blank words in the following paragraph in the numbered spaces at the right.

Since the moon does not produce its own light, you see it by (1) light from the sun. As you observe the moon night after night, you find that the lighted part seen (2). The lighted parts of the moon seen at different times are called the (3) of the moon. When the moon is in a position so that it is between you and the sun, the side you see is (4) and is called a (5) moon. As the moon revolves around the earth, you first see a thin (6) of lighted surface. In about a week, when about half of the moon is lighted, it is called the (7) moon. As the moon continues to move around the earth, it reaches a postion where the entire side facing the earth is in sunlight and now appears as a (8) moon. In another week, the moon has moved to a position where only about half of the surface is lighted again, and this is called the (9) moon. When the moon is once more between you and the sun, the part of its surface turned toward us is dark again, and this marks the passage in time of one (10).

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

WHERE ARE YOU?

In this activity you will play with some of the navigating methods of the good old days of Spanish gold and pirates. You will need to use a globe or map which give longitude and latitude as well as an Astrolabe and the special marks in your room.

Set the astrolabe on one of the specially marked desks and make a sighting on 'sun number' for the problem you are working on. There are several problems. Be sure you are sighting the right sun numbers.

The problem is: Can you tell where you are from the information we will give you? Let it be known that it is possible. This activity involves some math work so be ready for it. We know that the earth rotates once every 24 hours and that there are 360 degrees in a circle or one rotation from this information we can determine that 1 hour is equal to 15 degrees longitude.

24 hour = 360 degrees - 1 day

360 hour = 15 degrees - hour

For example if the sun comes up at point A one hour before it comes up at point B, we know that point A is 15^{o} East of point B.

One other thing we must know and that is what time it is at 0^{o} longitude and what day it is. 0^{o} longitude was placed at an observatory in Greenwich, England. They could have put it any place on earth and would have worked fine as long as everyone used the same point of reference for East and West.

In finding your position you must also know where you are North or South of the equator. In the northern hemisphere this is very easy to determine by using the North Star which is in direct line with the Earth's axis. Therefore; the number of degrees the North Star is above the horizon is equal to your degrees North of the equator. In all of your problems you will be north of the equator.

Problem #1

You have been traveling East all day. Last night you took a fix on the North Star and it was 30° above the horizon. Now you checked your watch that is set on Greenwich time, and see that it is 4 p.m. Now take a 'fix' on 'Sun number 1' with your astrolabe. Remember the sun is at 90° at noon and if it's to the east the local time is a.m. And if it is to the west it is p.m. Also remember that each hour is equal to 15°.

The day in both places is March 22.

Where exactly are you? (The name of the nearest big city)

_____ Today's Date

Problem #2 (This is a make believe problem for a real city)

You have been traveling West for several days now. Last night you took a fix on the North Star and found it was 50° above the horizon. You now check your watch and see that it is 12 noon in Greenwich. Take your astrolabe and sight on Sun number 2 from a special marked desk. It is the same date both places.

What is the local time?_____

Where are you?_____(nearest big city)

Todays date

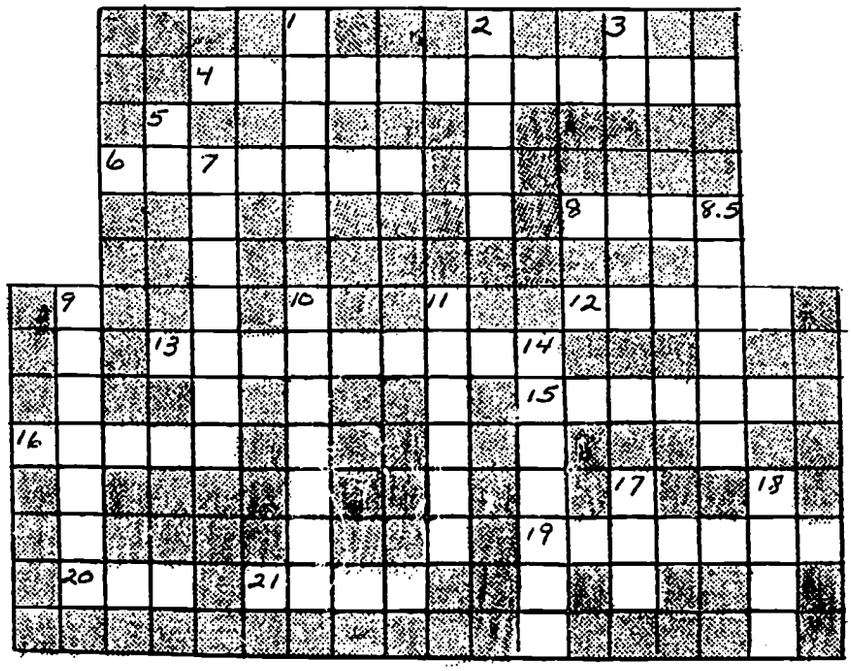
Problem #3

If you were marooned on an island and you had no idea of where on the earth's surface you were, what instruments and information would you need to determine your latitude and longitude?_____

_____

_____

CROSSWORD PUZZLE



ACROSS

4. Instrument that breaks light into its different colors.
6. Planet closest to sun.
8. Planet with orbit next to Earth's.
12. Planet with much life.
13. Instrument that enlarges the image of distant objects.
15. Records pictures of heavenly bodies.
16. Path of planets around sun.
19. Wanderers.
20. Two thousand pounds.
21. Time for one revolution.

DOWN

1. Earth's sister planet.
2. Heavenly body with tail.
3. Yes or _____
5. Symbol of Helium.
7. Mirrors cause light to _____.
8.5, Planet with rings
9. Lenses cause light to _____
10. To go around sun once.
11. To spin on axis one time.
14. Cut off the light from the sun.
17. Time needed for one spin of the earth.
18. Our sun is a medium sized _____.

MOON SURVIVAL TRIP
Requirement #10

INSTRUCTION: You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200 mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

_____Box of matches

_____Food concentrate

_____50 feet of nylon rope

_____Parachute silk

_____Portable heating unit

_____Two .45 calibre pistols

_____One case dehydrated Pet Milk

_____Two 100 lb. tanks of oxygen

_____Stellar map (of the moon's constellation)

_____Life raft

_____Magnetic compass

_____5 gallons of water

_____Signal flares

_____First aid kit containing injection needles

_____Solar-powered FM receiver-transmitter

G.A. Cunningham
R.L. Iverson

Marshalltown, Ia. 72

THE STARS IN SPACE

TEXTS:

Modern Science (EMS) (Holt)
Earth Science World We Live In (ABC)
Modern Science I (Holt)
Science/A Search for Evidence
Science 2
Investigating the Earth (H&M)

NAME _____

CLASS _____

TEST DATE _____

REQUIREMENTS:

1. Study E.M.S. pp. 133-148 and do part A. Page 147
2. Study Earth Science. Page 374-399 and answer Question 2 and 3 on page 399.
3. Study A Search for Evidence. Page 243-246, do Part A "Test Yourself", just the letter on page 246.
4. Write a short meaning to "Words to Remember" on page 74 of Modern Science I.
5. Do "How Can You Detect Star Brightness". Write up. (After demonstration). See pages 5-7.
6. Do Current Science questions as assigned.
7. Do Star Finder Lab. See pages 8-10.
8. Do "Ever Expanding Universe" Lab. See page 11.
9. Do "Annual Position of Stars" Lab. See page 12.
10. Do Investigating Spectra Lab. See page 13-14.

SUPPLEMENTAL ACTIVITIES:

1. Make a star chart showing the four constellations around the North Star.
2. Attend 1 "Star Finder" night session. (As scheduled by instructor.)
3. Write out answers to questions on 141 and 145 of (E.M.S.)
4. Do part B Questions for Thought on page 147 and 148. (E.M.S.)
5. Do "Proper Motion Lab. See page 15.
6. Do a selected Science project as arranged with instructor.
7. Review 3 filmstrips.
8. Do Crossword Puzzle. Page 16.
9. Annual Positions of Constellations. Page 17-18.
10. Care of Science Room. (1 hour total work)

GRADES:

For a C: Do all requirements.

For a B: Do all requirements and 2 supplemental activities.

For an A: Do all requirements and 4 supplemental activities.

FOR FULL CREDIT HAVE ALL WORK CHECKED BY INSTRUCTOR AS YOU DO IT AND BEFORE TEST DAY.

FILMSTRIPS:

Work of Astronomers and Space Travel.
Constellations
Comets and Meteors
Stars and Galaxies
Light and How it is Reflected

TAPES:

Modern Science (E.M.S.) pages 133-137
Modern Science (E.M.S.) pages 137-148

FILMS - SOUND

6665 Sound Waves and Stars. Dopples effect.
6226 Science of Light

FOR SUGGESTED SCIENCE PROJECTS SEE:

1. Pages 132, 148 or 175 of E.M.S.

2. Page 246 A Search For Evidence.

3. Pages 402, 425, 465, 475, and 483 of Earth Science (World We Live In)

4. See the books listed below for other astronomy activities and information.

    1. Observation in Modern Astronomy
    2. Field Book of the Stars
    3. Naked Eye Astronomy
    4. Star Map for Beginners
    5. The Amateur Astronomer
    6. A Handbook of Practical Astronomy
    7. Astronomy (Baker)
    8. Astronomy (EBBighauser)
    9. Other Earth Science Texts

Pages 6,7,9,10,14 and 15 are adapted from Blanc and Fischler, Exercises and Investigation for Modern Science Earth, Matter and Space, 1967
Holt, Rinehart and Winston, Inc., pp. 47-52.

THE STARS IN SPACE

BEHAVIORAL OBJECTIVES:

1. After completing this LAP, the student shall be able to explain:

   (a) The four main differences between stars and planets.

   (b) Luminous and reflected light and how each relates to heavenly bodies.

   (c) Factors affecting star brightness and the significance of brightening in determining a stars physical characteristics.

   (d) Factors affecting a star's color and the significance of color in determining a stars physical characteristics.

   (e) The purpose of the light year and how large distances in space are measured.

   (f) The importance of binary stars and their place in the star-space story.

   (g) The student will be given an objective type test to determine if he has knowingly learned the above explanations. This test will be announced in advance (at least 2 days). He will be expected to score 75% or more on this test.

2. The student shall be able to name and locate 4 major constellations located near the North Star (100%).

3. The student shall be able to describe in writing the 3 main kinds of galaxies and give an example of each. He may be expected to recognize each kind from a descriptive paragraph. (100%)

4. The student will be able to list (in writing) 4 differences between the "big bang" and "steady state" hypotheses and tell how each relates to the "ever expanding universe idea." (75%)

5. Given a set of diagrams, the student will be able to determine in which figures the items are in the same relative positions and which ones are not within the same relative positions. (80%)

6. Given a balloon and a marking pencil, the student will be able to demonstrate that objects can move further apart or closer together without changing their relative position with 100% accuracy.

MAIN FACTS AND CONCEPTS

1. A luminous body is an object which shines by its own light.
2. A light year is a unit used to measure distance in space and is about 6,000,000,000,000 (six trillion) miles.
3. The scale used to classify the brightness of stars is called magnitude.
4. A giant cloud of gas or dust found in a galaxy is called a nebula.
5. Examples of spiral galaxies are the Milky Way and Andromeda.
6. Constellations are groups of stars forming patterns in the sky.
7. A star which increases in brightness and then gradually fades is called a nova.
8. A pulsating star is one which increases and decreases in brightness on a regular cycle.
9. An extremely bright star caused by a giant explosion is called super-nova.
10. Stars become dwarf stars when they cool off and shrink.
11. Stars which have a red color are coolest.
12. Stars of the 6th magnitude are the faintest ones that can be seen with the bare eye.
13. Binary stars are made up of two stars revolving around each other
14. The common name for Polaris is North Star.
15. A star's energy comes from nuclear fusion.
16. The amount of light reaching the earth from a star depends on its size and distance.
17. Hydrogen is changed to Helium in nuclear reactions in stars.
18. We live in the Milky Way galaxy.
19. The big bang hypothesis states that a dense body exploded into a tremendous cloud of matter to form the galaxies.
20. One of the nearest galaxies to our own can be located by looking at the constellation Andromeda.
21. Each magnitude is 2½ times as bright as those stars in the next fainter magnitude.
22. The steady state hypothesis states that the universe had no beginning and will have no end.
23. Scientists listen into space by using radio telescopes.
24. Luminosity is the actual brightness of a star compared to the actual brightness of the sun. (The sun's Luminosity is said to be one.)

P.P. 135, 136 E.M.S.

How can you detect changes in brightness?

1. The demonstration on 136 of E.M.S. will be performed by an instructor. Fill in the following chart as the demonstration progresses.

Position of Bulbs	Meter changes in brightness
Both facing you	
The smaller behind the larger	
The larger behind the smaller	

Fill in the blanks:

1. How are stars classified? _____

_____

2. The apparent brightness of a star is called it's _____
3. A star of magnitude 2 is about _____ times brighter than a star of magnitude 1.
4. A star that increases and decreases in brightness on a regular cycle is called a _____ star. Name one: _____
5. Stars that revolve in pairs are called _____ stars.
6. A star that suddenly gets brighter and stays that way for some time is called a _____.
7. Do pages 6 and 7 of this L.A.P.

THE STARS IN SPACE

A. WHAT ARE STARS?

1. Name four types of information astronomers can get by studying the light given off by stars? (a) _____

(b) _____ (c) _____ (d) _____

2. Generally speaking, how do the temperatures of the following types of stars compare? (a) red stars _____ (b) yellow stars? _____ (c) blue-white stars _____

3. What is the distance in miles from the earth of a star that is 6.5 light years away? _____

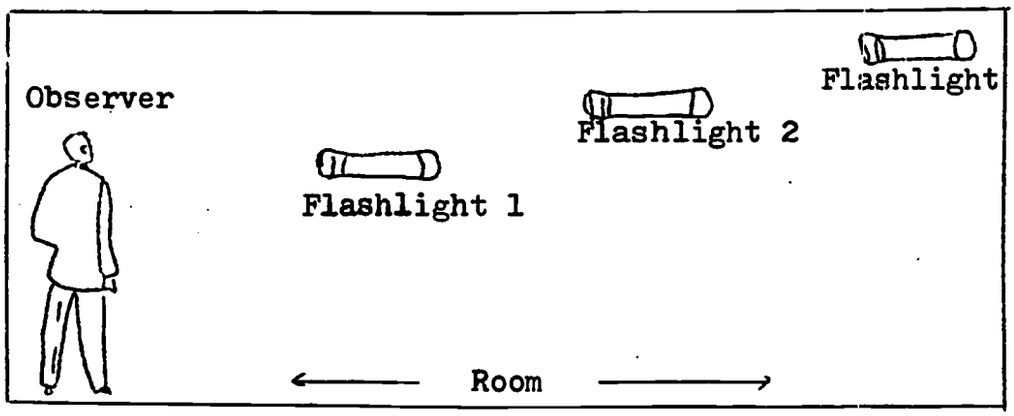


Fig. 5-1

4. If you arranged three small flashlights of the same light intensity in a long, darkened room so that they were at different distances from the observer, as seen in Fig. 5-1, how would the brightness of flashlight #1 compare with flashlight #3?

_____

5. Suppose you considered flashlight #1 to have a magnitude of one.

(a) What would be the comparable magnitude of flashlight #2 _____

(b) What would be the magnitude of flashlight #3? _____

6. How does the brightness of one star compare with that of another star one magnitude fainter? _____

_____

7. The table at the right shows how the magnitude scale for the first six magnitudes of stars is arranged. Each magnitude is 2.51 times as bright as the one just below it. For example, the relationship of brightness between a magnitude 2 star and a magnitude 3 star is found by multiplying the value for the magnitude 2 star by 2.51 (6.31 x 2.51 = 15.80). Show how the relationship of brightness between a magnitude 5 star and a magnitude 6 star is found _____

Magnitude Scale

Difference in magnitude	Relationship of brightness
1	2.51
2	6.31
3	15.80
4	39.90
5	100.00
6	251.00

8. From our part of the earth, about how many stars can be seen that are (a) first magnitude? _____ (b) second magnitude? _____ (c) third magnitude? _____

9. Name a star group that has a star which changes in brightness in a regular cycle. _____

10. What do scientists believe causes changes in brightness of certain stars? _____

_____

Tell what each term means.

luminous body _____

_____

light year _____

_____

eclipsing binaries _____

_____

pulsating star _____

_____

supernova _____

_____

Summary: Briefly explain what you have learned in this activity.

STAR FINDER

Using the "Star Finder" perform the following exercises:

1. Demonstrate to an instructor that you know how to hold the chart. Instructors O.K. _____
2. What star maintains its relative position over the North Pole? _____.
3. Name the two stars in the Big Dipper that serve as pointer stars when locating the North Star _____, _____
4. On what date at 11 p.m. is the middle star in Cassiopea directly South of the North Pole? _____
5. At what date at 7 p.m. does Orion appear on the Eastern Horizon? _____
6. On what date at 7 p.m. does Orion disappear on the Western Horizon? _____
7. Set the star chart showing the stars positions at 8 p.m. today.
8. Do pages 9 and 10 of this L.A.P.

WHAT ARE GALAXIES?

1. What is the name of the galaxy of which our solar system is a part? _____

2. Where in the galaxy do scientists believe our sun is located? _____

3. What is the diameter of our galaxy in light years? (a) _____
   (b) How many light years thick is our galaxy? _____

4. Does our solar system seem to be moving in our galaxy? (a) _____
   (b) If so, at what speed? _____

5. What two main kinds of bodies seem to make up the Milky Way galaxy? (a) _____ (b) _____

6. List the three main shapes in which galaxies appear from the earth. (a) _____ (b) _____ (c) _____

7. Are the galaxies moving away from each other or toward each other? _____

8. Name the three theories which try to explain the movement of the galaxies. (a) _____ (b) _____
   (c) _____

Tell what each term means.

galaxy _____

_____

nebula _____

_____

big bang hypothesis _____

_____

steady state hypothesis _____

_____

pulsating hypothesis _____

_____

Summary: Briefly explain what you have learned in this activity.

WHAT ARE CONSTELLATIONS?

1. About how many stars can be seen with the unaided eye? _____

2. If you could measure the angles above the horizon of a bright star in the western sky one hour apart with a sextant (see pages 98-99) in Modern Science: Earth, Matter, and Space, would the star appear to move across the sky? (a) _____ (b) If so, in what direction would this movement take place? _____ (c) What is the reason for such apparent motion? _____

3. Suppose you are standing under a street light at night, as shown in Fig. 5-2, and you walk away to the south from the light. (a) In what direction does the light appear to move? _____ (b) As you keep going south, does the light appear to move closer to the horizon? _____ (c) Why is the North Star seen above the Northern horizon from where we are located? _____

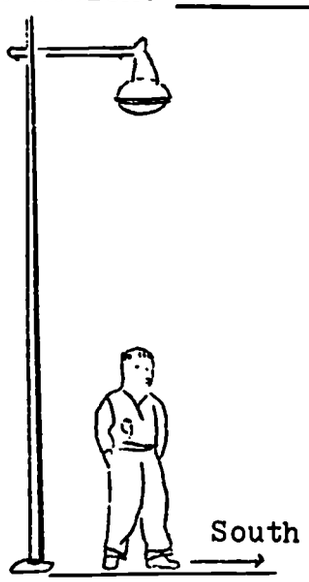


Fig. 5-2

4. Why do the constellations seem to move around the North Star at different seasons of the year? _____

5. Are the stars really "fixed" in their positions, or are they moving with respect to one another? (a) _____ (b) What are these motions called? _____

6. Generally, how does a change in color of a star indicate its relative age? _____

7. On what two things does the amount of light from a star seen on earth depend? (a) _____ (b) _____

8. About how much of its hydrogen has our sun used up? _____ How long will it probably be before our sun goes into its late stages? _____

EVER EXPANDING UNIVERSE

Earth Science - pp. 394-395
M.S.I. - pp. 72-73

The Galaxies are moving away from each other. Astronomers using modern photographic telescopes have discovered through these instruments, that the galaxies appear to be moving away from our own galaxy at high rates of speed in all directions. The most distant galaxies seem to be moving away at higher speeds than those closer to the Milky Way galaxy. If all galaxies are moving away from us, it follows that the galaxies are also moving away from each other. You can illustrate this by the following activity.

Blow up a balloon part way, holding the neck closed, paint a few dots about the size of a dime all over the surface of the balloon as shown in fig. 1.

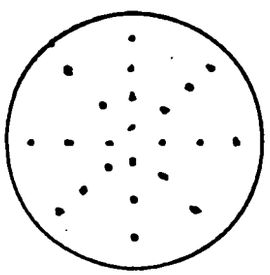
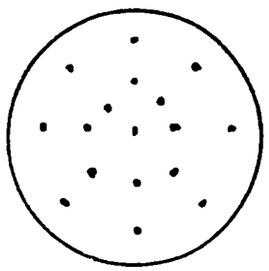


Fig. 1



Now blow the balloon up to full size. What happened to the space between the dots? _____

What seems to be happening to the other "galaxies" as the balloon gets bigger? _____

This activity demonstrates that the universe is _____

The two hypotheses that explain that the universe is expanding are: (Write a brief descriptive paragraph of each)

1. _____

2. _____

3. Describe the sun's spectrum. _____

_____

4. How can the sun's spectrum help you in studying stars? _____

_____

ANNUAL POSITION OF STARS

Page 138 E.M.S.

At the front of the room is a set of Christmas tree lights fastened to a sheet of cardboard. Darken the room and turn on the Christmas tree lights. Walk around the room looking at the lights. Notice that the lights seem to change position with respect to each other. Sometimes it is hard to tell which bulb is nearest. Draw sketches of the bulbs as they appear from 5 positions in the room.

Looking at the bulbs from different positions in the room is like looking at the stars from different positions on the earth's orbit as the earth revolves during a year. The stars appear to change position from month to month but don't really. It is we who change position as the earth revolves. When the earth has completed a revolution, the star will again appear to be in the same positions as they were the year before.

Draw your sketches on a sheet of white paper provided by the instructor.

Fill in the indicated blanks.

1. Did the stars (bulb) appear to change position with respect to each other? _____

2. Did they really change position with respect to each other? _____

3. This is called _____ motion.

4. This motion is caused by the earth's _____.

5. There would be no _____s if the stars really changed position with respect to each other.

6. Now do pages 14 and 15 of this L.A.P.

OBJECTIVE:

After completing this activity, you should be able to observe the stars at various times during a year and know that their apparent change in position is caused by the earth's revolution. I. E. The change in your position has caused an apparent change in the stars position. You should also be able to predict the apparent changes in position of stars some time in advance.

INVESTIGATING SPECTRA

About 300 years ago, Newton passed sunlight through a glass prism. Although sunlight looks yellowish-white, Newton showed that it actually contains all the colors of the rainbow. A century and a half passed before scientists thought of placing a narrow slit in front of the prism to make the first spectroscope. With this instrument, the sun's spectrum was discovered to be not a continuous rainbow of colors, but to be crossed by many dark lines. In this investigation, you will examine the dark-line spectra of several stars to see if you can see any relationships among them.[1]

PROCEDURE

PART A

Using a spectroscope (the instructions are on the side of the tube) look at and draw the spectrum of an ordinary light bulb, a flourescent tube, and day light. (DO NOT LOOK DIRECTLY AT THE SUN BECAUSE YOU MAY DAMAGE YOUR EYES.) Use colored pencils to draw each s spectrum. Use all of the space procided for each spectra.

Light bulb

Fluorescent tube

Daylight (sun)

[1] Earth Science, The World We Live In, page 377-382, starting with topic 6.

Questions to Part A:

1. How can you tell the spectra of the fluorescent tube from that of the incandescent bulb or the sun?

2. How can you tell the difference between the incandescent bulb spectra and that of the sun with the equipment that you have?

3. A spectrum produced by a glowing gas under low pressure is called _____-_____ spectrum. Give an example.

4. A spectrum produced by a glowing solid or liquid or a gas under high pressure is called a _____ spectrum. Give an example. _____.

5. An absorption spectrum can also be called an _____ spectrum.

Part B:

Now that you know a little about a spectra and have used a spectroscope, it's time to see if you can identify some unknown elements by their spectra. We will set up a light source at your request (if it is not already in operation) and you will need to use the spectroscope to identify the glowing gas in the tube. Do at least <u>two</u> of these. To help you do this you will need to use the charts on page 533 of <u>Investigating the Earth</u> (Blue Book) or the wall chart of spectrum in the room.

Draw the identifying parts of each spectrum. (<u>Have These Checked Immediately</u>)

A. [ ] Name of Gas _____

B. [ ] Name of Gas _____

What kind of spectrums did you look at? _____

Do more for fun if you like.

PROPER MOTION OF STARS

E.M.S. p. 140

In spite of what you learned in the "Apparent Motion" activity, the stars really do move in respect to each other. This motion is called the "Proper Motion" of stars. Of course stars are so far away that their proper motions can only be observed over a period of many years.

Since the stars are moving in relation to each other, it follows that the constellations did not always have the same arrangement of stars as they have at present. In the space below, make the indicated sketches.

1. The Big Dipper as it appeared thousand of years ago. (Indicate direction that stars are moving.)

2. The Big Dipper as it appears now. (Indicate direction of star motion.)

3. The Big Dipper as it will look 50,000 years from now. (Indicate direction of star motion)

Answer the following questions:

1. Define "Proper Motion" _____

_____

2. Why can't we detect proper motion of stars on a "day-to-day" basis? _____

3. How long have scientists known about proper motion of stars? ____

4. How many stars are there in the Big Dipper? _____

5. Are all of the stars in the Big Dipper moving the same direction? _____

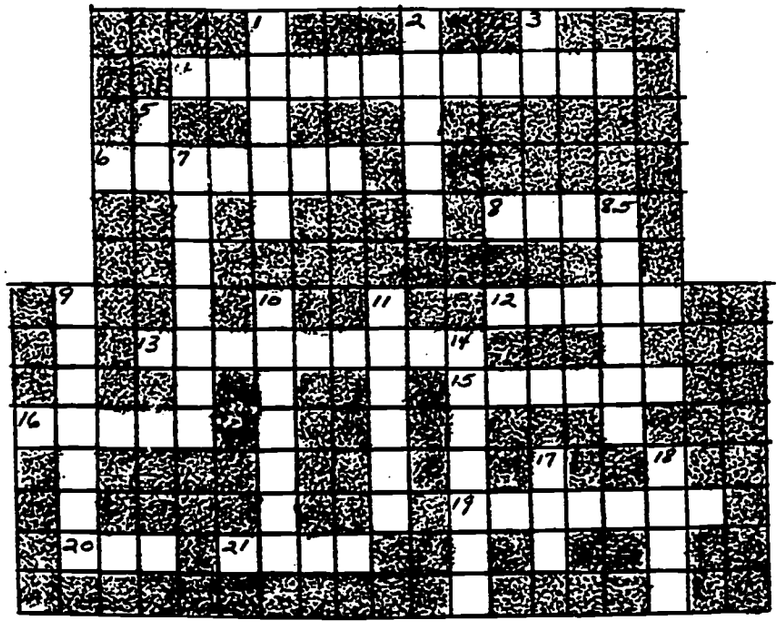
6. Are the stars in the other constellations moving? _____

Explain: _____

7. How fast are most stars moving? _____

8. What is the name of the brightest star in the Little Dipper? _____

CROSSWORD PUZZLE



ACROSS

4. Instrument that breaks light into its different colors.
6. Planet closest to sun.
8. Planet with orbit next to Earth's.
12. Planet with much life
13. Instrument that enlarges the image of distant objects
15. Records pictures of heavenly bodies
16. Path of planets around sun
19. Wanderers
20. Two thousand pounds
21. Time for one revolution

DOWN

1. Earth's sister planet
2. Heavenly body with tail
3. Yes or _____
5. Symbol for helium
7. Mirros cause light to _____
8.5 Planet with rings
9. Lenses cause light to _____
10. To go around sun once
11. To spin on axis one time
14. Cut off the light from the sun
17. Time needed for one spin of the earth
18. Our sun is a medium sized ____

ANNUAL POSITIONS OF CONSTELLATIONS

PROBLEM

The earliest observers noted that the seasons of the year could be told from the changing positions of the constellations in the sky. If you were to observe the constellations at different times of the year, how would their positions change?

INVESTIGATION

By means of a star map similar to the one shown in Fig. 5-3, the positions of some of the constellations are compared with the numbers on the face of a clock. Their relative positions seen from our part of the earth during the four seasons of the year are shown in the table on the following page.

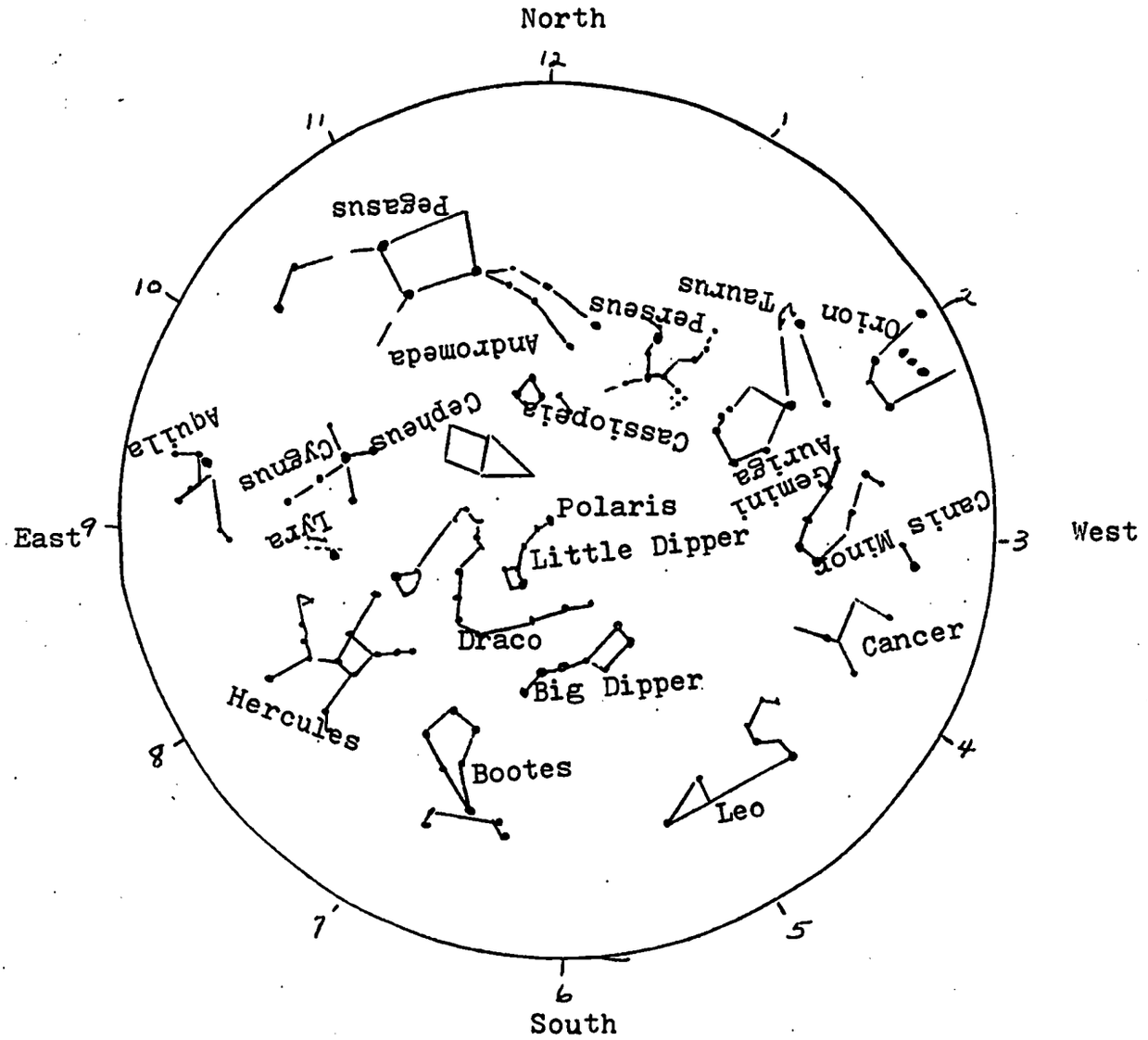


Fig. 5-3

Relative Positions of Some Constellations

Month	Season	Big Dipper	Draco	Cepheus	Cassiopeia	Perseus
January	winter	4:00	7:00	9:00	10:00	12:00
April	spring	1:00	4:00	6:00	7:00	9:00
July	summer	10:00	1:00	3:00	4:00	6:00
October	fall	7:00	10:00	12:00	1:00	3:00

INTERPRETATION

According to the results of the observations shown in the table, mark each of the following statements true, false, or not proved in the space provided.

1. The position of the Big Dipper changes by about three hours from one season to the next. 1. _____

2. The constellations appear to move from west to east from summer to fall. 2. _____

3. In the constellation Cepheus, one of the stars is a pulsating star. 3. _____

4. The North Star is in the same place in the sky at different seasons. 4. _____

5. The two pointers in the Big Dipper always points toward the North Star. 5. _____

6. If you were standing at the North Pole, the North Star would be directly overhead. 6. _____

7. There is a difference of about two hours in the positions of the constellations Cepheus and Perseus. 7. _____

8. In one year, the constellations appear to move halfway around the "clock" face. 8. _____

9. The stars in the constellation Perseus have a greater magnitude than in the constellation Draco. 9. _____

10. There is a difference of about three hours in the positions of the constellations Draco and Cassiopeia. 10. _____

APPLICATION

Explain how a navigator uses his knowledge of the positions of the constellations to locate his position on the earth.

_____

_____

_____

THE GIANT BUBBLE OF SPACESHIP EARTH

TEXTS:
Modern Science - Earth, Matter and Space
Earth Science - The World We Live In
Air Pollution Primer

NAME _____

CLASS _____

DUE DATE _____

REQUIREMENTS:

- ☐ 1. Study in Modern Science - Earth, Matter and Space pages 343-358 and answer "Questions for Thought" part A on page 360.
- ☐ 2. Review pages 494-636 in Earth Science The World We Live In.
- ☐ 3. Study in Modern Science - EMS pages 211-235 and answer "Questions for Thought" part A on page 234.
- ☐ 4. Study in Modern Science - EMS pages 237-266 and answer "Questions for Thought" part A on page 266.
- ☐ 5. Study in Modern Science - EMS pages 183-210 and answer "Questions for Thought" part A page 209.
- ☐ 6. Dew Point Lab. See page 8.
- ☐ 7. Weather for the Continental U. S. Lab. See pages 9-10.
- ☐ 8. Solution - Suspension Lab. See page 11.
- ☐ 9. Current Science Questions as assigned.
- ☐ 10. Write a short definition to the "Words and Terms to Remember" in Objective 11.

SUPPLEMENTAL ACTIVITIES:

- ○ 1. Independent project dealing with Environmental Quality in Marshalltown. (Care of Science Room is a good one.)
- ○ 2. Air density lab. See page 12.
- ○ 3. D. O. Lab. See pages 13-14
- ○ 4. Weather in Marshalltown. See page 15.
- ○ 5. Cloud formation. See page 16.
- ○ 6. Particulate Air Pollution Lab. Air Pollution Primer. Read pages 30-34 and pages 17-18.
- ○ 7. The Internal Combustion Engine and Pollution. Pages 19-20
- ○ 8. Properties of Co_2 Lab. See page 22.
- ○ 9. Book review of environmental oriented book. See instructor.
- ○ 10. Review 3 film strips.
- ○ 11. Crossword Puzzle. See page 23.

BEHAVIORAL OBJECTIVES

1. Given four surfaces with equal radiation the student will be able to predict which surface will become the warmest in 10 minutes with a 75% accuracy.
2. Having completed the activities relevent to air quality the student will be able to write a short paragraph expounding the need for air treatment to prevent air pollution.
3. Given a barometer the student will be able to read it with 90% accuracy.
4. Given various sets of conditions the student will be able to determine method of heat transfer with 80% accuracy.
5. Having completed the dissolved oxygen lab the student will be able to identify a minimum of three factors directly related to the D.O. content of water.
6. After completing the readings and activities related to water the student will be able to write a paragraph indicating our sources of water and problems of maintaining the quality of the water.
7. Given an appropriate thermometer the student will be able to read temperatures with 90% accuracy.
8. The student will be able to describe a thermal air inversion by means of a diagram with 80% accuracy.
9. Given a completed weather map the student will be able to obtain the following information:
   (a) Location of highs
   (b) Location of lows
   (c) Predict direction of movement by fronts
   (d) Wind direction and speed
   (e) Forecast next days weather for any spot on the map.
10. Given a map including both rural and urban areas the student will develop a zoning pattern compatable with human existence.
11. The student will write a short definition to the following words and terms:

1. Barometer	13. Contract	25. Warm front
2. Radiation	14. Air pressure	26. Climate
3. Troposphere	15. Calorie	27. Weather
4. Nitrogen	16. Areation	28. Hurricane
5. Oxygen	17. Water table	29. Herbiside
6. Carbon Dioxide	18. Specific Heat	30. Pestiside
7. Conduction	19. Dew point	31. Primary H_2O treatment
8. Convection	20. Iosobar	
9. Oxidation	21. Cyclone	32. Secondary H_2O treatment
10. Pollution	22. Anemometer	
11. Atmosphere	23. Air mass	33. Tertiory H_2O treatment
12. Expand	24. Cold front	

GRADES:

C - Requirements only

B - Requirements plus 2 Supplimental Activities

A - Requirements plus 4 Supplimental Activities

ENVIRONMENTAL BOOK LIST

Air and Water Pollution - Leinwand

Air Pollution Primer

Basic Ecology - Buchsbaum

Concepts of Ecology - Kormandy

Conservation - Joyce Joffe

Conservation Education - Caravajal

Dangerous Air - Kavaler

Ecology - Odum

Exploring Earth and Space - Hyde

Guidance Activities for Teachers of Science - Munson

Famine 1975 - Paddock

Moments in the Sun - Reinow

Man's Impact on Nature - Lauwerys

Nature's Network -Reid

Pestides and the Living Landscape - Rudd

Plants, Man and the Ecosystem - Billings

Population Resources Environment - Paul and Ann Ehrlick

Reading in Conservation Ecology - Cox

Role Playing for Social Values - Shaftel

Science and Survival - Barry Commoner

Sciences: Institute for Public Information Workbook

Shadows Over the Land - McCoy

The Ecology of Animals - Elton

The Environment Handbook - DeBell

The Only Earth We Have - Pringle

Environment, Resources, Pollution, and Society - Murdoch

Water We Use & Misuse - Conservation Bulletin No. 3

This Vital Air - This Vital Water Aylesworth

The Hungry Planet - Borgstrom

The Subversive Science - Shepard

Too Man - Borgstrom

The World You Inherit - Navarra

1. Aeration is a means of purifying water by spraying it into the air.
2. Filtration is a process in which a liquid is passed through a filter to remove undissolved particles.
3. The earth's surface is about three-fourths covered with water.
4. Water has a specific heat of 1.
5. Relative humidity refers to the amount of water vapor in the air at a given temperature compared to the amount of water vapor that could be in the air at that temperature.
6. Because of its molecular structure, water expands as it freezes.
7. Water is a good coolant because it has a high specific heat.
8. The dew point is the temperature at which water vapor condenses.
9. Water boils at 212°F (100°C).
10. Water freezes at 32°F (0°C).
11. A calorie is the amount of heat needed to raise the temperature of a gram of water 1°C. (This is the specific heat of water.)
12. The transfer of heat energy by circular movement in a gas or liquid is convection.
13. The layer of the atmosphere closest to the earth is the troposphere.
14. The transfer of heat energy by waves through space is radiation.
15. As one goes higher into the atmosphere, the amount of oxygen decreases.
16. Atmospheric pressure decreases at a constant rate with a rise in altitude.
17. The atmosphere is a mixture of oxygen, nitrogen, carbon dioxide, and other gases.
18. Conduction is the transfer of heat energy by collision of molecules.
19. The best absorbers of heat are surfaces that are dark and rough.
20. Air expands when heated.
21. A calorie is the amount of heat needed to raise the temperature of one gram of water one degree centigrade.
22. The cooling of warm moist air as it rises is the chief cause of cloud formation.
23. Land surfaces heat and cool more rapidly than water surfaces.

24. The climate of a region is affected by its distance north and south of the equator.

25. An air mass is said to be cold when it is colder than the surface over which it rests or is moving.

26. An air mass is said to be warm when it is warmer than the surface over which it rests or is moving.

27. A front is usually defined as a boundry between two air masses.

28. Cold front: the leading edge of an advancing mass of cold air.

29. Warm front: the leading edge of an advancing mass of warm air.

30. Cold front rains are showery, are of short duration, and are usually associated with cumuliform clouds.

31. Warm front rains are steady and extensive and are usually associated with stratiform clouds.

32. Climate is the weather conditions of an area over a long period of time.

33. Seasons are a result of the movements of the earth in its yearly path around the sun.

34. Water must have a constant supply of dissolved oxygen to support most life. Lack of dissolved oxygen is called "organic pollution."

35. Foreign substances in water that are harmful are called poisons and are associated with "chemical pollution".

36. Primary water sewage treatment is the removal of solids by letting them settle out.

37. Secondary water sewage treatment is the distractor of organisms and dissolved materials by filtration and aeration.

38. Tertiory water sewage treatment is the processing of the sludge from primary and secondary treatment.

39. Particulate air pollution is that caused by solid particles in the air.

DEW POINT

PROBLEM: At what temperature does condensation take place? (dew point)

MATERIALS:
1. a shiny can
2. thermometer
3. ice

PROCEDURE:
1. Fill the can half full of water.
2. Record the temperature of the water in the container.
3. Place a small quantity of ice in the container and stir gently.
4. Keep repeating step 3 until you first notice dew appearing on the outside of the containers. When this happens, record the temperature.
5. Now empty the water from the container and repeat the procedure. Be sure you give time for your container to warm up to room temperature between trials.
6. If after 10 minutes there is still no dew, add a small amount of salt to the water.

RESULTS:

	1st trial	2nd trial	3rd trial
Water temperature before starting			
Temperature when dew forms on metal container			

QUESTIONS:
1. Where did the water on the outside of the container come from?
2. What is the relationship of the dew point to relative humidity of the room?
3. What would you have to do to raise the dew point in this room?
4. What would you have to do to lower the dew point in this room?

THE WEATHER IN THE CONTINENTAL UNITED STATES

A. Select a weather map from a local newspaper or magazine. (The Des Moines Register is a good source.)

B. Copy the following items on the weather map that is found in your unit from the one you found in the newspaper. Be sure to attach the weather map from the newspaper or magazine to the one you make.

1. High pressure areas
2. Low pressure areas
3. Fronts (warm, cold, or stationary)
4. Select any three cities and mark in the weather conditions for that particular day (cloud cover, precipitation, high and low temperature)

WEATHER MAP

WEATHER FORECAST			
DATE	TIME	PRESENT WEATHER	FORECAST
TEMPERATURE			
RELATIVE HUMIDITY			
BAROMETRIC PRESSURE			
WIND			
PRECIPITATION			
REMARKS			

LEGEND

COLD AIR / WARM AIR — COLD FRONT

COLD AIR / WARM AIR — WARM FRONT

COLD AIR / WARM AIR — STATIONARY FRONT

H — HIGH PRESSURE; L — LOW PRESSURE — PRESSURE

CLEAR; PARTLY CLOUDY; CLOUDY — CLOUDS

RAIN; SNOW; TRACE; FOG — PRECIPITATION

No. PV

SOLUTIONS & SUSPENSIONS

PROBLEM: How can you identify a solution and a suspension?

MATERIALS:
1. sugar, salt, cornstarch
2. 4 containers
3. Funnel
4. filter paper

PROCEDURE:

1. Put a small quantity (one teaspoon) of each of the following substances in separate beakers with 50 milliliters of water: sugar, salt, cornstarch.
2. After thoroughly stirring the mixture in each beaker, filter them one at a time. Use a fresh piece of filter paper for each one.
3. Observe the results of each beaker and each piece of filter paper and answer the following questions.

QUESTIONS:

1. Taste a small quantity of the liquid in each beaker before and after you have filtered them. What did you find?

2. What is a solution? (Define)

3. What is a suspension? (Define)

4. Which of the above samples were solutions and which were suspensions?

5. If you were given a container with a liquid in it exactly how would you find out whether it is a solution or a suspension?

AIR DENSITY LAB

1. Fill a balloon with air and seal its mouth. Measure the balloon's circumference. Float the balloon in a pan of hot water for a few minutes. Now measure its circumference again. How can you explain the results?

Circumference of balloon at start _____.

Circumference of balloon at end _____.

2. Weigh a stoppered flask carefully. Then heat the flask, after removing the stopper. Quickly replace the stopper and weigh the flask again. What are your results?

Weight before heating _____.

Weight after heating _____.

Is there a difference between your first and second readings?

What explanation can you give to account for your data? (See page 196 of Modern Science EMS.)

DISSOLVED OXYGEN LAB.

The purpose of this activity is to acquaint you with factors that effect the oxygen level of water. The importance of dissolved oxygen can be found on the tape "An Introduction to Water Pollution" and other books. Also you will be working with some different materials that proffessional investigators use to measure the quality of our environment. How to make the test is described below. You will need to make several tests.

1. The first test you make should be made on tap water from the faucet in C-1 marked HOT (this is really the cold water)

   Tap water _____ppm.

Repeat with tap water. If you get the same answer, fine - but if you don't, do it over until you can get a consistent answer.

2. Now take a tap water sample and heat it to 95°C and run a D.O. _____ ppm.

3. Next take tap water and cool it to at least 10°C and shake it in a large container with lots of air. Now do a D.O. _____ppm.

4. Your final test will be to take a field kit and go to the stream that runs by Franklin Field and run a D.O. test on the water._____

5. How does heating effect the D.O. in water?

6. How does cooling and agitating effect the D.O. in water?

7. How does decaying organic matter effect the D.O. of water?

   * Prove it for an independent project credit. Everything you need is in the room and available.

HOW TO RUN A DISSOLVED OXYGEN TEST

Collection of the Sample:

Collect the sample in the 60 ml glass stoppered bottle by allowing the sample to overflow for two or three minutes. The water should be run into the sample bottle through a glass or rubber tube extending to the bottom of the bottle. Withdraw the filling tube while the water is flowing, making certain that the bottle is filled to overflowing, and carefully stopper the sample bottle. See Note A. A convenient sampler is available for sampling streams, lakes, etc.

Procedure:

1. Carefully remove the stopper from the glass stoppered bottle and add the contents of one Dissolved Oxygen I Powder Pillow and the contents of one Dissolved Oxygen II Powder Pillow.

2. Stopper the bottle carefully so that air is not trapped in the bottle. Invert several times to mix. A flocculant precipitate will be formed which, if oxygen is present, will be brownish-orange in color. Allow the sample to stand until the floc has settled and leaves the upper half of the bottle clear. Again, invert several times and let the sample stand until the upper half of the bottle is clear.

3. Carefully remove the stopper and add the contents of one Dissolved Oxygen III Powder Pillow. Stopper again and invert to mix. The floc will dissolve and, if oxygen is present, will leave a yellow iodine color.

4. Accurately pipet a 5.8 ml sample of the above solution into the titration flask.

5. Add PAO Solution for Dissolved Oxygen dropwise, counting the drop and swirling the flask after each drop is added, until the sample changes from yellow to colorless. The ppm Dissolved Oxygen is equal to the number of drops added. See Note B.

Notes:

A. To avoid trapping air bubbles in the dissolved oxygen bottle when stoppering, incline the bottle somewhat, and insert the stopper with a quick thrust. This will force the air bubbles out.

B. If increased sensitivity is desired, a 29 ml sample is used. This is measured by carefully pouring off the prepared sample from the glass stoppered bottle until the liquid is level with the mark around the middle of the bottle. The sample is then titrated directly in the bottle. Each drop is now equal to 0.2 ppm Dissolved Oxygen.

C. PAO is not decomposed by bacterial action as is Sodium Thiosulfate, and it is, therefore, inherently much more stable. PAO is, however, decomposed by ultraviolet radiation and should be kept protected from direct sunlight except when in actual use.

THE WEATHER IN MARSHALLTOWN

For a period of seven days record the following weather conditions for the Marshalltown, area. Make your observations at the same time each day.

1. Temperature
2. Atmospheric pressure
3. Relative humidity
4. Cloud type
5. Wind speed (see page 237 in Modern Science)
6. Wind direction
7. Precipitation
8. Forecast (see page 258 in Modern Science)

Date							
Temperature							
Air pressure							
Humidity							
Cloud type							
Wind speed							
Wind direction							
Precipitation							
Forecast							

CLOUD FORMATION

(If all else fails - follow direction!)

For cloud formation, the following three ingredients are essential.

1. Water vapor mixed with air
2. Condensation nuclei (dust, salt, carbon particles, etc.)
3. Cooling (Adiabatic Cooling)

To form the cloud, the first two ingredients must be thoroughly mixed. This mixture is them cooled. The cloud should form. (with luck and proper procedure)

To do this activity, you will need: a gallon jug and stopper assemble.

PROCEDURE:

(1) Rinse the jug by filling it completely with water and then pouring the water down the drain.

(2) Place about $\frac{1}{4}$ inch of fresh water in the jug.

(3) Insert the stopper with the hose and clamp attached.

(4) Draw as much air from the jug as you can by sucking on the hose. (You may do this with the vaccuum pump of your preference) Then pinch the hose closed with the clamp.

(5) Look for the cloud in the jug. Is it there? _____ Did we forget something? _____ If so what? _____

(6) Start over, try again. Be sure to add the forgotten ingredient this time. If you don't know how or what, ask an instructor. (He might tell you)

(7) Now look for your cloud. Is it there now? _____ Wonderful! (If it's not there, try again) Now answer the following questions about this activity.

(1) Define adiabatic cooling. _____

_____

(2) At what point in this activity was adiabatic cooling taking place? _____

(3) Where did the water vapor come from? _____

(4) What served as the condensation nuclei? _____

(5) How can you make the cloud go away? _____

PARTICULATE AIR POLLUTION LAB.

"The air-contaminating activities of civilization fall into 3 general categories: (1) attrition, (2) vaporization, and (3) combustion."

Attrition is the production of particulate (solid particles) by the processes grinding or wearing down by friction or dispersal by pressure. Some examples would be grinding, sanding, blasting, dulling, or spraying.

Vaporization is the changing of a liquid to a gas. This can happen naturally by evaporation or by heating a liquid. This will cause a big stink or other gases that can be poisonous, but this does not add solids in the air.

Combustion is the processes of burning whether it's in a trashcan or jet plane or the family car. Combustion puts particles into the air as well as many foreign gases due to vaporization caused by heat and pressure.

In the activity we are interested in collecting and examining some of the particles in the air around school. For this activity you need:

(a) super-clean slides
(b) petrolium jelly
(c) microscope (use the black one with slanted eye piece)

What to do:

A. Spread a super-thin layer of petrolium jelly on one slide. This is the thinnest possible layer-no globs or wauds. Try to get the layer as uniform over the surface of the slide as possible. Set the slide outside in an open spot for 15 minutes. You will need to mark your slide so you can identify because there may be many slides lying around. After 15 minutes examine the slide on low power (100X) and count the number of particles you see.

B. How to count particles:

Place the slide on the microscope stage and focus. (See film loop "See it Big" if you need to, on how to operate the microscope or where to find them) The circle you see is the microscopes' field. Now count all of the particles (black dots) you see in one field. Without looking in the microscope move the slide to another spot and then look in the microscope and refocus if necessary and count the particles in that field - do this five times. Place your information on the chart. If your slide shows nothing, try it again.

Exact location of the slide: _____

Time it was placed out: _____

Count in field: #1. _____

#2. _____

#3. _____

#4. _____

#5. _____

TOTAL _____

AVERAGE _____

Compare your data with that of others if possible. What factors effect the numbers of particles falling on your slide?

After seeing the shapes of some of the particles, do you believe they could irritate your eyes or lungs?

THE INTERNAL COMBUSTION ENGINE AND POLLUTION

The purpose of this activity is to get some idea of what part gasoline engine as we know them today play in polluting our environment. There are several books in the classroom and library that will give you more information for example the Air Pollution Primer on pages 23-25. There are many quaint sayings in environmental studies such as: "Pollution is dirty business", but there is one that is equally true but offers some insight into past actions, and that is "the solution to pollution is dilution" and this works until you run out of air or water to dilute with. On the other hand if less pollutants are put into the air the less air it takes to dilute it. There are two parts to this activity - one inside with exhaust gas from a gasoline engine and one outside asking the question where are the gases coming from, and finally deciding for yourself if there is something you can do. The very last part - the part we won't check on because the answer will only come with time is, if you know what you can do - will you do it? If you do, what is the reason? (a) you are a good person (b) Congress passed a law (c) You can not economically afford to be bad (d) You are concerned about what other people think (e) You are an intelligent human being acting on the basis of facts in your own best interest.

What to do:

Find a nice spot in the middle of a block and count every car that goes by and how many people are in the car for 15 minutes. Keep track of which direction each car is going. I would suggest that you record the number of persons in each as well as the number of cars. Do not count trucks or buses or other service vehicles.

Time _____ Date _____ Street Condition _____

Location _____

Cars going to my left _____

Cars going to my right _____

Total passengers going left _____

Total passengers going right _____

Total cars _____

Total passengers _____

What per cent of the cars had only one person in them _____

What per cent of the cars had 2 persons in them _____

What per cent of the cars had 3 persons in them _____

What per cent of the cars had 4 or more persons in them _____

Would your parents like it if you could catch a bus to any place in town within 10 minutes? _____

This means they would not have to run you all over town to this and that. Ask them. In Iowa City it has been this way for 3 months and people are really riding the buses. One bus doesn't pollute any more than some cars, yet can carry more people. Don't forget the two wheelers that pollute very little.

Read pages 21-28 in Air Pollution Primer before you get this checked. Bring the book with you when you come to have it checked.

_____

PREPARATION AND PROPERTIES OF CARBON DIOXIDE

PROBLEM: How is carbon dioxide prepared?

MATERIALS:
flasks and stopper set up
pieces of marble
dilute hydrochloric acid
wood splints
limewater
test tube

PROCEDURE:

1. Place several pieces of marble in the bottom of a flask.
2. Insert a stopper with a funnel in it.
3. Fill the test tube with water and invert it and place it in a pan of water. (Be sure the test tube is completely full of water.) See diagram page 204 Modern Science EMS.
4. Pour a small amount of dilute hydrochloric acid slowly into the flask through the funnel. Note what begins to take place.

PROPERTIES:

1. As soon as all of the water is romoved from the bottle, place a burning wood splint into the bottle.

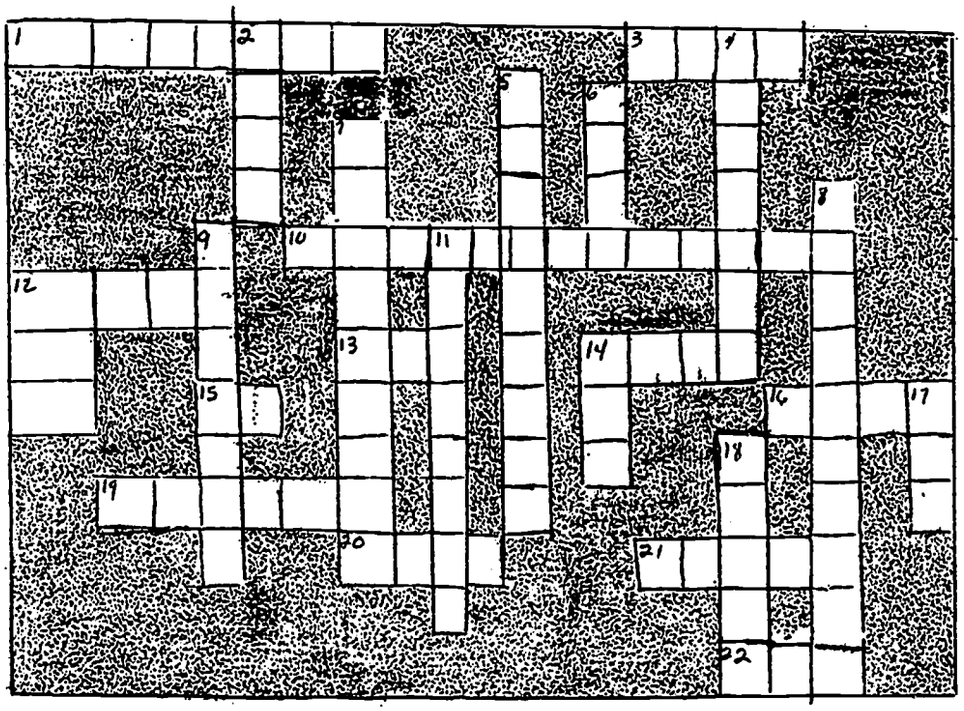
   What happens? _____

2. What happens when limewater is poured into the bottle?

   _____

3. List 4 properties of CO_2 that you have observed.

   1. _____
   2. _____
   3. _____
   4. _____



ACROSS

1. Cloud formation-large, bellowy, cotton-like.
3. Particles on which rain often forms.
10. The many forms of water that fall to the earth.
12. Barometer reading that usually means good weather.
13. Male intelligent animal.
14. Wind direction is determined by a wind----------.
15. Opposite of yes.
16. Forcing a liquid to change to a gas by adding heat.
19. Change from a liquid to a solid.
20. Flower that has thorns.
21. Solid form of H_2O that formed on cold objects.
22. Thick, dark material used on some roads and roofs.

DOWN

2. Solid form of precipitation. (spell it backwards) It forms layers before falling to the earth.
4. Change directly from a gas to a solid without becoming a liquid.
5. Change from a liquid to a gas.
6. Change from a solid to a liquid.
7. Instrument to measure air pressure.
8. Instrument to measure wind speed.
9. Lightning and _____.
11. Change from gas to liquid.
12. Female chicken.
14. Abbreviation for "Very Important Person"
17. Pressure for bad weather.
18. Place where 2 air masses meet.